EXAMINING THE PREDICTIVE FACTORS OF A DOUBLE BURDEN OF UNDERNUTRITION AND OBESITY ACROSS SUB-SAHARAN AFRICAN COUNTRIES

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Abstract:

The double burden of malnutrition, defined as the coexistence of obesity and undernutrition, is a contemporary Public Health issue in Sub-Saharan Africa. The “nutrition transition” theory has been used to discuss the major shift in diet and activity patterns at the population level. Socioeconomic development, increased inequality and urbanization have been attributed to the increasing prevalence of obesity in Sub-Saharan African countries, whilst food insecurity and subsequent malnutrition remain a salient issue this region. I will be examining the relationship between GDP, the GINI index, urban population density, and the double burden of malnutrition in 48 Sub-Saharan African countries.
Introduction

Despite the global pandemic of obesity, extreme hunger and malnutrition have remained a problem in developing countries. The United Nations made “Ending hunger, achieving food security and improving nutrition, and promoting sustainable agriculture” the second Sustainable Development Goal for the year 2030 (United Nation 2017). This goal was aimed at addressing global malnutrition, which refers to a deficit or imbalanced intake of nutrients, that is particularly prevalent in children and marginalised communities. However, recent health patterns indicate an increasing prevalence of overweight and obesity in Sub-Saharan countries, which contradicts the tale of impoverished, nutrient deficient populations. The World Food Programme (WFP) reports that 44 countries are experiencing a double burden of malnutrition, which refers to the coexistence of undernutrition and obesity (World Food Programme 2017). Undernutrition is a deficiency of micronutrients and calories and can lead to stunted growth, wasting (Black et al., 2013). Obesity stems from an energy imbalance derived from a complex interplay of behavioural, genetic, environmental, and social factors. More specifically, obesity demonstrates the relationship between modifiable risks, such as diet, physical activity, smoking/alcohol, and non-modifiable risks, such as genetics, age and gender (Cheng, 2012).

The double burden of malnutrition can be examined as an outcome of socioeconomic processes demonstrated through a “nutrition transition”, which refers to major shifts in diet and activity patterns at the population level (Popkin 2006). The nutrition transition also encompasses changes in the population’s health status, including an increasing prevalence of non-communicable diseases (NCDs), such as diabetes, coronary heart disease and other nutrition-related illnesses (Du et al. 2004). Issues on adequate caloric and nutrient intake remain in many low-income countries and middle-income countries, whilst also experiencing a nutrition transition that has led to an increase in overweight and obesity in both rural and
urban populations, which serves as risk factors for NCDs. The nutritional transition and its effect on redefining dietary trends and consumption is increasingly fostering an environment with diets based on higher intakes high caloric foods, and edible oils (Popkin 2006). Factors influencing this shift include technological advancements in food processes, marketing and distribution (Dearth-Wesley et al. 2011). Diet changes have been influenced by free market trade policies and economic growth measured as Gross Domestic Product (GDP) increases and a lower GINI coefficient as an economic measure for wealth inequality, which have made unhealthy foods more affordable and accessible (Du et al. 2004). This study will explore the predictive factors for the relationship between the coexistence of overweight/obesity and undernutrition, and socioeconomic variables such as GDP and the GINI coefficient in Sub Saharan African countries.

**Literature Review**

Lifestyles and diet changes have been linked to the global obesity pandemic. As developing countries undergo modernization, urbanization, and economic development, Western diet patterns have been increasingly adopted. Studies in China have shown a shift away from traditional Chinese foods of low energy-density high-fibre foods toward more meat, oil and other higher-energy-density foods. Popkin, Lu, and Zhai (2002) found that by the late 1990’s, a higher fat diet was consumed by over a third of Chinese adults aged 20-45, and over 60% of adults living in urban areas. Changing consumption trends in China are indicative of the nutrition transition present in other regions, and explain the increasing obesity rates in China. It then seems plausible that both extreme cases of nutrient imbalances can occur. The implications of this phenomena are significant when we consider that many Sub Saharan African countries are beginning to experience obesity prevalence rates that are greater than undernutrition (Mendez, Monteiro, and Popkin 2005). A growing body of research has shown evidence that GDP, GINI and urban population density as markers/
outcomes of globalisation are contributing to a shift in food availability, access and preference.

**Undernutrition in Sub-Saharan Africa**

Across the Sub-Saharan African region, food insecurity remains a challenge for population health and human development improvements, because undernutrition is still salient, particularly in vulnerable populations. Countries in Sub-Saharan Africa have the highest prevalence of undernutrition. Kimani-Murage et al. (2015) present a study on the double burden of malnutrition in urban poor settings in Nairobi, Kenya; they found that the occurrence of maternal and child undernutrition is particularly high in East Africa, with a prevalence above 10% in mothers, and almost 50% of young children experiencing stunted growth. However, shifts in dietary patterns has been linked to the rise of non-communicable diseases over undernutrition in developing countries (Du et al. 2004).

The theoretical term “nutritional transition” has been used to describe the major shift in diet and activity patterns at a population-wide basis, specifically shifts in dietary patterns and trends based on diets with higher intakes of animal and partially hydrogenated fats and lower intakes of fibre (Popkin 2006). Free market practices and economies of scale have promoted certain foods, such as vegetable oils and other fats as well as animal sourced foods in the market, with relatively low and competitively advantageous prices, thus extending their affordability to people in various income brackets (Du et al. 2004). The increase in food options materialised in fast food outlets and street food in low income settings; this has fostered an obesogenic environment, shifted food trends, and increased consumption of processed, energy dense foods (Kimani-Murage et al. 2015; Steyn and Mchiza 2014).

Kimani-Murage et al. (2015) report that these rapid changes marked by the nutrition transition also include epidemiological changes in health statuses as an increasing prevalence
of NCDs such as diabetes, coronary heart disease and other nutrition related illnesses. Many
developing countries are experiencing a nutrition transition that has led to an increase in
overweight and obesity in both rural and urban populations. It is key that we note that
undernutrition serves as marker of a country’s development index. Therefore, it imperative
that we consider the effects of socioeconomic development, urbanisation and acculturation in
understanding a dual burden of undernutrition and obesity (Popkin 2006).

Evidence for a double burden

There are a growing number of sub Saharan African countries facing a double burden
of malnutrition (Mendez, Monteiro, and Popkin 2005). Socioeconomic developments and
urbanisation in Sub-Saharan Africa coupled with the burden of unhealthy diets and
inadequate activity is now shifting from those of higher socio-economic status (SES) to those
of lower SES (Kimani-Murage et al. 2015). Mendez, Monteiro, and Popkin (2005) conducted
a comprehensive study of 36 developing countries, and found that the prevalence of
overweight among urban women ranged from 10.3-69.9%. This held true in rural and urban
settings where the median overweight: underweight ratio was 2:1 in rural areas and 5:8 in
urban areas, meaning that the burden of overweight surpasses that of underweight. This
speaks to the socioeconomic indicators of malnutrition. Kimani-Murage et al. (2015) found
that a double burden of malnutrition does exist amongst the urban poor in Nairobi, Kenya.
After examining 3335 children and their mothers, the analysis showed a high prevalence of
undernutrition in children in their early formative years. - 45.4% were stunted, 10.9%
underweight, 2.4% wasted, whereas 8.8% overweight/obese. The occurrence of
multimorbidity, defined as the burden and coexistence of multiple illness, has been looked at
in South Africa. Researchers found that 465 of respondents out of a sample of 11,638 adults
had two or more chronic diseases, with diabetes ranking as the highest contributor to
multiborbidity (Alaba and Chola 2013). Whilst this translates to 4% of the sample population,
we must consider the continuing effects of the nutrition transition. The increasing prevalence of obesity as a predictor and risk factor for diabetes is changing the discourse on nutrition. Therefore, I will discuss the burden of this coexistence and its relation to global health issues.

Developmental indicators

It is important to recognize that nutritional outcomes are based on a series of determinants such as food security, maternal health, access to clean water, sanitation measures, food environment, lifestyle, culture, and economics. These all refer to the social determinants of health, which include economic and social conditions that influence and indicate the health status of people and communities. Nutrition is a powerful indicator for health; however, this and other indicators are shaped by the amount of money, power, and resources that people have, all of which are influenced by policy choices and access (Alaba and Chola 2013). Socioeconomic status measured as income and education influence health at multiple levels throughout the life course. The socioecological model expands on these layers of influence that increase a person’s risk for disease. This involves looking at the microlevel determinants such as the individual behaviours and gradually moving out towards the macro level determinants such as the environment. This model demonstrates a complex interplay of behavioural, genetic, environmental, and social factors such that social and economic inequalities can hinder any incentive to improve health and may contribute to the onset of disease and illness related to the double burden of malnutrition.

Using the theoretical framework of the social determinants of health we can examine the interplay between the individual choice, interpersonal networks, community and larger societal factors to understand the nutrition transition and the double burden of malnutrition in developing countries. The role that environmental influences including urbanization, policy
interactions and social interactions play in the process of disease outcomes, particularly obesity and NCDs as well as in the evolution of inequality in health and nutrition is salient in developing countries. The burden of overweight/obesity and undernutrition exposes the health disparities prevalent in developing countries as they undergo structural changes in their economies and rising urbanisation. The study conducted by Du et al. (2004), examines the impact of rapid income growth on diet behaviour across the socioeconomic gradients in China. In the wake of globalisation and economic growth in China has increased disposable income and elevated people out of poverty from a high of 80% in 1978 to less than 12% in 1998 (Du et al. 2004). They found changes in the Chinese diet that now favours high caloric foods, and this reflects increases in income due to a positive income effect experienced between 1989-1997 (Du et al. 2004).

As an indicator for socioeconomic growth, urbanisation in developing countries has been occurring over time, and studies have also shown that an increase in overweight/obesity exists in these settings. Mendez, Monteiro, and Popkin (2005), found that a high prevalence of overweight exists in developing countries with an urbanisation threshold of 32%. Pawloski et al. (2012) demonstrated the double burden of overweight/obesity and undernutrition in mothers and children using a geographical analysis in Kenya. In their study, they demonstrate the coexistence of overweight/obese mothers and stunted children using geographic location. There are variations of overweight prevalence in urban and rural settings based of Gross Nation Income (GNI) indices (which is the total domestic and foreign output claimed by residents of a country), and urbanisation. As urbanisation and GNI increase, the difference in overweight/obesity prevalence in urban and rural decreases (Mendez, Monteiro, and Popkin 2005).
However, the burden of malnutrition is more evident in low income populations in developing countries. Du et al.’s (2004) findings show evidence to support the idea that the income effects adversely affect the poor. In China, the shift away from traditional foods, which were based off rice and wheat, in favour of higher intakes of edible oils and animal products is prevalent in low income groups. Furthermore, stir-fry as a cultural food item uses excessive amounts of oil, which has contributed to increased fat consumption. The poor are more vulnerable to the effects of prices changes for basic necessities such as food. Due et al. (2004) found that food demand was more price- and income-elastic, thus limiting the types of food those from a lower socioeconomic bracket could afford. However, lower food prices create an affordable market for more fat and high energy foods, as predictive of a nutrition transition. Animal products and edible oils have been shown to serve as indicators of cultural and socioeconomic capital suggesting that their consumption implies that an individual has the financial liberty to diversify and improve diet (Du et al. 2004). However, consumption patterns show that it is the poor who bear the burden of the nutrition transition supporting studies that show higher BMIs in low socioeconomic groups. Social inequalities translate to health inequalities, where the risk of becoming obese differs across different life experiences and circumstances and this is a public health and sociological concern.

As Sub-Saharan African countries undergo modernization, urbanization, economic development, and increased incomes, the prevalence of overweight/obesity must be studied. Holmes et al. 2010 suggest that studies about the West’s obesity epidemic cannot be applied to understand the results of double burden in Africa. Therefore, this research will be important in understanding the drivers behind the nutrition transition and its effect on the double burden of malnutrition, which will be crucial for shaping health policy and addressing population-wide health issues in Sub-Saharan Africa. The narrative of nutrition in developing countries needs to address the coexistence of undernutrition and the rise in obesity and its
link to other nutrition-related diseases. I will look at how developmental indicators such as Gross Domestic Product (GDP) and the GINI coefficient as an economic measure for social inequality are related to the double burden of malnutrition. Therefore, this study will discuss the drivers of this coexistence of overweight/obesity and undernutrition as countries undergo socioeconomic development, urbanisation and a higher GDP outcomes.

Research Question(s):

What factors are important in predicting the prevalence of a double burden of undernutrition and overweight/obesity in developing countries across Sub-Saharan Africa?

Hypotheses:

1. GDP per capita is a strong predictor for a high prevalence of undernutrition and overweight/obesity in developing countries in Sub-Saharan Africa.

I expect countries with positive GDP growth to have high rates of obesity over their undernutrition rates, thus, demonstrating the predictive effect of GDP on a country’s nutrition transition and overall population health

2. High GINI index will be strong predictor for a high prevalence of undernutrition and overweight/obesity in developing countries in Sub-Saharan Africa.

I expect that countries with high GINI coefficient will show high rates of undernutrition combined with high rates of obesity. The GINI coefficient, as a measure of wealth distribution, will explain how income inequality is related to health disparities and disproportionately affects low income groups.

3. A higher overweight: underweight ratio corresponds with countries that have a higher urban: rural ratio.
I expect that countries with a high urban population density will have a high obesity prevalence because it supports the claim that urbanisation fosters an obesogenic environment due to less traditional food patterns.

The hypotheses aim to test the effect of three world development indicators on the double burden of malnutrition. This is important for understanding the population health. Given that NCDS are a global health concern, countries in Sub-Saharan Africa need to evaluate their own risks for increasing obesity prevalence for future policy recommendations and national health interventions.

**Methods**

I will conduct a repeated cross-sectional study - a range from 2010-2014. There are some missing data for child malnutrition, therefore I have made the time dimension an inclusive range from the years 2010 to 2014. I am including all the countries in Sub-Saharan Africa therefore, my unit of analysis for this study is the 48 African Countries in the Sub-Saharan African region (Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Comoros, Congo, Democratic Republic of Congo, Cote d'Ivoire, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Nigeria, Rwanda, Sao Tome and Principe, Senegal, Seychelles, Sierra Leone, Somalia, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Togo, Uganda, Zambia, and Zimbabwe).

**Double Burden of Malnutrition data:**

To test the hypothesis on the prevalence of underweight and overweight, I will use information on the following anthropometric measures of a double burden: Body Mass Index (in kg/m2). Overweight prevalence is classified BMI ≥ 25 and obesity prevalence as
BMI ≥ 30. Anthropometric measures of child malnutrition is taken as a prevalence of severe wasting in children under 5 years. I will also look into prevalence data on underweight in children under 5 years. Lastly, I will use prevalence data on stunting in children under 5 years. The relative magnitude of the two occurrences of malnutrition for each country will be calculated as:

\[
\text{Prevalence of undernutrition} \text{ (wasting, underweight and stunting and in children)} + \text{prevalence of overweight} \text{ (BMI >25) and obesity (BMI > 30)}
\]

Data will be extracted from the Global Health Observatory survey dataset complied by the World Health Organization, thus ensuring that it is nationally representative. I will use the most updated data for countries in which the surveys were conducted in the period of 2010-2014. The data are appropriate for answering the three hypotheses I have made. The World Bank and World Health Organization data sets are highly robust, comprehensive and nationally representative. They provide a large enough sample to generalize to the general population. However, one shortcoming is the missing data for some countries; Angola, Botswana, Cabo Verde, Madagascar, Mali, Mauritius, Somalia and South Africa because of missing data on child malnutrition.

**Development Indicators:**

Associations between the nutritional status of urban people and each country’s per capita gross domestic product (GDP) and level of urbanization will be explored in the 48 countries. I will be using these socioeconomic predictors: GDP, % of healthcare expenditure per capita, GINI Coefficient, and urban population density. I have sourced this country level data from the World Bank Open Data source using the world development indicators.
**Dependent Variable:** Double Burden measured as:

- **Undernutrition Prevalence** [wasting, stunting and in children]

**Independent Variables:** GDP per capita, GDP growth per capita, % of healthcare expenditure per capita, Total expenditure on health as a % of GDP, GINI index, Urban population density.

**Control Variables:** Year, Proportion of population under 15 years and over 60 years.

I will conduct a regression analysis of my variables to determine the relationship between the socioeconomic development indicators and the double burden of malnutrition in Sub-Saharan Africa.

**References**


Dearth-Wesley, Tracy, Penny Gordon-Larsen, Linda S. Adair, Anna M. Siega-Riz, Bing Zhang and Barry M. Popkin. 2011. "Less Traditional Diets in Chinese Mothers and
Children are Similarly Linked to Socioeconomic and Cohort Factors but Vary with Increasing Child Age." *The Journal of Nutrition* 141(9):1705-1711


**Annotated Bibliography:**


This article by The Lancet, examines maternal and child malnutrition in low-income and middle-income countries as both undernutrition and growing problems with overweight and obesity develop. Low body-mass index, indicative of maternal undernutrition, has declined somewhat in the past two decades but continues to be prevalent in Asia and Africa. They estimated that undernutrition in the aggregate—including stunting, wasting, and deficiencies of vitamin A and zinc along with suboptimum breastfeeding—caused 45% of all child deaths in 2011. Maternal overweight and obesity result in increased maternal morbidity and infant mortality. Childhood overweight is becoming an increasingly important contributor to adult obesity, diabetes, and non-communicable diseases.


This article analyses of economic and food availability data for 1962-1994 reveal a major shift in the structure of the global diet marked by an uncoupling of the classic relationship between incomes and fat intakes. It considers how the nutrition transition now occurs at lower levels of the gross national product than previously, and is accelerated further by high urbanization rates.

This study was conducted to assess the prevalence and differentials of overweight/obesity in preschool children in Sub-Saharan Africa. Their findings reflect that overweight/obesity should be recognised as problem in this region.


This study looks the high levels of undernutrition, particularly stunting, that have persisted in Kenya, like in other developing countries. The relationship between vitamin A supplementation and growth of children in Kenya has not been established, while there are context-specific variations on the relationship. The study demonstrates that receiving vitamin A supplement may be beneficial to growth of young children in Kenya.


This article explores the coexistence of over and undernutrition at the neighbourhood and household level, in an urban poor setting in Nairobi, Kenya. The findings confirm an existing double burden of malnutrition in this setting, characterized by a high prevalence of undernutrition particularly stunting early in life, with high levels of overweight/obesity in adulthood, particularly among women.


This article examines the prevalence of obesity and the metabolic syndrome. They conclude that this incidence is rapidly increasing in developing countries, leading to increased morbidity and mortality due to type 2 diabetes mellitus (T2DM) and cardiovascular disease in both children and adults.


This article discusses how several major changes seem to be emerging, leading to a marked shift in the structure of diet and the distribution of body composition in many regions of the world: a rapid reduction in fertility and aging of the population, rapid urbanization, the epidemiologic transition, and economic changes affecting populations in different and uneven ways. Thus, we see problems of under- and overnutrition often coexist, reflecting the trend in which an increasing proportion of people consume the types of diets associated with a number of chronic diseases.

This article documents the high levels of overweight and obesity found across higher- and lower-income countries and the global shift of this burden toward the poor and toward urban and rural populations.


This article discusses how the rapid increases in the rates of obesity and overweight are widely documented, from urban and rural areas in the poorest countries of sub-Saharan Africa and South Asia to populations in countries with higher income levels. Concurrent rapid shifts in diet and activity are well documented as well. Furthermore, a series of large-scale programmatic and policy measures are being explored in a few countries; however, few countries are engaged in serious efforts to prevent the serious dietary challenges being faced.


This narrative review examines the nutrition transition and its consequences when populations in Africa undergo economic development, urbanisation and acculturation. It focuses on dietary patterns and nutrient intake. They conclude that is possible to steer the nutritional transition in a more positive light for the African continent.


This study looks at the prevalence of undernutrition in many developing countries. They observe that it is decreasing, but many challenges still prevail. They examine the determining factors that influence childhood nutrition in Kenya and Zambia.


This study examines patterns of adult female overweight and underweight in the developing world through an urban vs. rural lens. The nutritional status in both urban and rural settings shows that overweight exceeds underweight in over half the countries.

This review highlights the nutrition transition in sub Saharan Africa as it effects the development of obesity and obesity related illnesses. The increase in obesity is marked through socioeconomic status, gender, age, parity, physical activity, and increased fat, energy and sugar intake.


This study looks at the negative impact of increased income on Chinese diet patterns. The income effect has increased disposable income, but this has decreased the consumption of tradition foods in favour for more high energy dense food that are linked to obesity and obesity related illnesses.