Economic growth and obesity in South African adults: an ecological analysis between 1994 and 2014

Running head: Economic growth and obesity in South Africa

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Abstract

Background: To assess the trend associations between South Africa's economic growth using various economic growth indicators (EGIs) with adult obesity prevalence over a specified period of time.

Methods: Data for obesity levels reported was obtained from national surveys conducted in South African adults between the periods of 1994 to 2014. EGIs incorporated in the current analysis were obtained from the World Bank and IHS Global insight databases. Obesity prevalence is presented by gender, urbanisation level and ethnicity. EGIs congruent to the time points where obesity data are available are presented. Unadjusted time trend plots were applied to assess associations between obesity prevalence and EGIs by gender, urbanisation level and ethnicity.

Results: Females present higher levels of obesity relative to males for all time points. For both males and females, an overall increase in prevalence was observed in both rural and urban settings over-time, with urban dwellers presenting higher obesity levels. An overall increase in Gross Domestic Product (GDP) per capita and Household Final Consumption Expenditure (HFCE) per capita was observed. The Gini coefficient for all ethnicities except the white group increased between 1998 and 2003 but declined by 2012. Overtime per capita GDP and HFCE increased with increasing obesity prevalence in both genders. The Gini coefficient for all ethnicities and obesity prevalence trend association for both genders were similar in that as the Gini coefficient increased obesity prevalence declined, and when the coefficient decreased obesity prevalence increased.

Conclusions: Trend associations exist between South Africa's economic growth and adult obesity.

Keywords: Economic growth, Obesity, South Africa, Adults, Body Mass Index

Introduction

Globally, obesity has become the most concerning public health problem, and is strongly associated with increased risk for type 2 diabetes, stroke, myocardial infarction and various cancers. [1,2] Available data suggests that the global burden of obesity is increasing worldwide[3,4] and low-middle income countries (LMICs) seem to be increasingly catching up with industrialised settings.[5] The transition towards improving economic growth has become the primary concern of governments especially in LMICs. Though this growth has brought about many improvements including improved access to health care, control in infectious communicable disease and improved quality of lives for many, this transition also stimulates other transitions that are not necessarily positive [1,6,7]. The lancet framework to categorise obesity determinants and solutions points to policy and economic systems including growth as a strong probable systemic or distal environmental driver of obesity.[1]

South Africa, a developing country that is rapidly getting industrialised, has the second highest GDP on the African continent[8,9], the most commonly used indicator of growth and national improvements in prosperity. This economic transition is additionally associated with demographic changes, rural to urban migration, and increased technological mechanisation. South Africa is experiencing a health transition attributable mainly to rapid urbanization and is characterised by the emergence of Non-Communicable Diseases (NCDs) including obesity, the Human Immunodeficiency Virus/Acquired Immune Deficiency Syndrome (HIV/AIDS) pandemic, and under-nutrition related infectious diseases.[10-14] This epidemiological transition in Africa has been associated with changes in dietary patterns and increased sedentary behaviour (reduced physical activity patterns).[7,12,14-19] Though economic growth through regional economic development strategies such as industrial cluster formation[20] is important it seems beyond a point diminishing returns are observed in relation to increased obesity and related NCDs. Several data exists reporting associations between economic growth, technological changes, socio-economic position, economic inequities and insecurity with obesity [6,21-26], but limited data or evidence are available in countries that exhibit characteristics of both under and over nutrition. In this paper we present the trend associations between South Africa's economic growth with adult obesity prevalence over a specified period of time.

Methods

Data Sources

Data for obesity levels incorporated in the current analysis was obtained from national surveys conducted in South African adults between the periods of 1994 to 2014. Body mass index (BMI) was used as an indicator to ascertain obesity status. Obesity was defined as a BMI ≥ 30 kg/m^2. Surveys from which data were obtained are described below in brief for which anthropometric data including weight and height were collected for participants aged 15 years and older.

South Africa Demographic and Health Survey (SADHS) 1998 and 2003[27,28]

The 1998 and 2003 SADHS collected information on the demographic and social characteristics of participants across all provinces in South Africa. In terms of distribution for the 1998 SADHS, 53% of the household population were females, while males constituted nearly 47% of the population. For females, 54% and 46% of the participants were from urban and a non-urban setting respectively which was comparable with men, 55% and 45% of the male participants were from urban and non-urban settings respectively.[27] In terms of distribution for the SADHS 2003, 54% of the household population were females and 46% were males. For females, 62% and 38% of the participants were from urban and a non-urban setting respectively which was comparable for men, 63% and 37% of the male participants were from urban and non-urban settings respectively.[28]

South African National Health and Nutrition Examination Survey (SANHANES-1) 2012[29]

SANHANES-1 was conducted to assess defined aspects of the health and nutritional status of South Africans with respect to the prevalence of NCDs and their risk factors. The survey applied a multi-stage disproportionate, stratified cluster sampling approach. A total of 25 532 individuals (92.6%) completed the interview whilst 7.4% refused to participate. This sample (25532) constituted of 64% and 36% participants from urban (formal and informal) and rural (formal and informal) settings. In terms of race, the proportions of African, Whites, Coloureds, Asian, and Indians and other were 69%, 4%, 20%, 8% and 0.3%. Physical and clinical examinations were conducted in the clinic for those that agreed to be interviewed. In this sample, 45% and 55% were male and female respectively.[29]

Economic growth indicators

EGIs data namely GDP per capita, HFCE, and Gini coefficients incorporated in the current analysis were obtained from the World Bank's world development indicators and IHS Global Insight databases.[8,30] Data for GDP per capita and HFCE are presented in U.S. dollars (constant prices 2005). GDP per capita is a crude measure of the income derived by the total population. It is calculated by dividing a country's total output (measured by GDP) in a given year by the total population in the same year.[8] HFCE is a measure of the value of all goods and services purchased by households excluding purchases of dwellings.[8] The Gini coefficient is a measure of the distribution of wealth and inequality in an economy.[8]

Data analysis

Obesity prevalence (%) for South African adults is presented by gender between 1994 and 2014. Obesity prevalence (%) is further illustrated and stratified by urbanisation level (rural vs. urban) and ethnicity. Economic growth data including GDP per capita, HFCE and Gini coefficients congruent to the time points where obesity data are available are presented. The trend associations between EGIs and obesity prevalence were computed by plotting unadjusted time trends for obesity prevalence against GDP per capita, HFCE per capita and Gini coefficients by gender and ethnicity between 1994 and 2014.

Results

Tables in the current manuscript present adult prevalence of obesity in the last 20 years, where data were available from nationally conducted surveys in South Africa. Obesity prevalence data were available for 3 time points in the last 20 years namely 1998, 2003 and 2012.

Table 1 presents adult obesity prevalence by gender. Females present higher levels of obesity (almost three fold) relative to males for all time points. An overall increase in prevalence was observed though a slight decrease of 0.5% and 2.7% was observed between 1998 and 2003 for males and females respectively (Figure 1).

Table 2 presents adult obesity prevalence stratified by gender and urbanization level. Between 1998 and 2012, for both males and females a trend is observed in that urban

dwellers present higher obesity levels as compared to rural dwellers (Figures 2 and 3). In both settings, obesity levels have increased for both males and females.

Table 3 presents adult obesity prevalence stratified by gender and ethnicity. For blacks, coloureds and Asians/Indians, females had higher obesity levels as compared to males for all the 3 time points whereas that trend does not hold for whites in that in 2003, males had higher obesity levels as compared to females. For males, whites and coloureds present the highest prevalence whereas Asians/Indians and Blacks present lower levels of obesity. For male whites and coloureds, an overall increase in prevalence is observed between 1998 and 2012. Black males present an overall increase in obesity levels between 1998 and 2012, though a slight decline of 0.6% was observed between 1998 and 2003. As for male Asians/Indians, an overall decline was observed between 1998 and 2012, but an increase was noted in 2003. For females, an overall increase in obesity levels was observed for blacks, coloureds and Asians /Indians, although a slight decrease of 2.0% and 1.8% was observed for blacks and coloureds respectively between 1998 and 2003. Concurrently white females also showed a significant decrease of 10.6% between 1998 and 2003. Data for both white males and females for 2012 was not computed as there were too few observations to record reliably.

Table 4 presents EGIs namely per capita GDP, HFCE and the Gini coefficient for the 3 time points for which obesity level data was available. For per capita GDP and HFCE an overall increase is observed between 1998 and 2012. As for the inequality indicator the Gini co-efficient, an increase of 0.03 from 0.64 is observed between 1998 and 2003 but it drops back to 0.64 in 2012 as observed in 1998. Between 1998 and 2012, the Gini coefficient for all ethnicities except the white group, indicates an increase between 1998 and 2003 but declines in 2012 (Table 5).

Figures 4-9 illustrate the trend associations between EGIs and obesity prevalence in adults between 1998 and 2012. GDP per capita positively associated with obesity prevalence. In both genders, a positive trend between GDP per capita and obesity was observed for blacks and coloureds, were as for the same plots Asians/Indians males and white females experienced fluctuating trends. HFCE per capita increased with obesity prevalence in both males and females (Figures 6 and 7). Between 1998 and 2012, the trend association between the Gini

coefficient for all ethnicities and obesity prevalence for both genders were similar in that as the Gini coefficient increased between 1998 and 2003, obesity prevalence declined, whereas when the Gini coefficient declined between 2003 and 2012, obesity prevalence in both genders increased (Figures 8 and 9).

Discussion

In this manuscript, the trend associations between South Africa's economic growth using various EGIs with adult obesity prevalence between 1994 and 2014 are reported. Females present higher levels of obesity relative to males for all time points. For both males and females, an overall increase in prevalence was observed in both rural and urban settings over-time, with urban dwellers presenting higher obesity levels. For blacks, coloureds and Asians/Indians, females had higher obesity levels as compared to males for all 3 time points whereas the trend did not hold for whites. Overtime per capita GDP and HFCE increased with increasing obesity prevalence in both genders. The trend association between the Gini coefficient for all ethnicities and obesity prevalence was similar for both genders in that as the Gini coefficient increased obesity prevalence declined, and when the coefficient decreased obesity prevalence increased.

Our findings suggest a positive association between GDP per capita and obesity prevalence. Increases in GDP per capita ascertain the improvements in prosperity of a nation and directly relates to improved individual socio-economic status (SES) through improved education and employment opportunities. This finding and trend is similar to those reported in other countries.[22] SES, a direct function of GDP per capita has additionally been highlighted as the main underlying factor for the observed positive association between GDP per capita and obesity levels. In a systematic review of studies assessing the relationships between SES and obesity in LMICs, a positive association existed for both genders.[21] In LMICs, the more affluent, better educated and employed are reported to be at a higher risk for obesity whereas in middle-income countries the associations between SES and obesity were mixed for men and mainly negative for woman.[21] This is also comparable to South Africa and attributable to the two extremes of economic communities namely the middle to high income group and the poor predominately in rural areas. The middle to high income group has always experienced higher obesity levels as compared to the poor but a gradual shift seems to have

been observed of late.[11] HFCE per capita is a direct function of improved household incomes. When income was used as an SES indicator associated with weight overtime in developed settings, findings were inconsistent. In the same review, there was little evidence to support SES and weight gain for black participants.[31]

In LMICs, during the early phases of the transition, obesity and NCD burden is higher in the higher SES class[10,31-34] whereas the burden is in the poor in developed countries.[31,35-39] In a study that examined the whether associations between SES and NCD risk factors including obesity in black South Africans had shifted from the more affluent groups to the less over a nine year period in both rural and urban participants, it concluded the burden of NCD risk is shifting to the poor and authors attributed this mainly higher educational levels in women influencing diets (decreased total energy and fat intake) though this was not observed in men.[11] We speculate that the urbanised and more affluent people have more information and have pressure to be healthier, consume prudent diets and have increased physical activity. Though the urban obesity prevalence are still higher, the rural setting seems to be increasing. The ever increasing rural-urban migration has exposed the once protected rural communities to more westernised lifestyles ultimately leading to increased obesity and NCD risk in this population.[11] An increasing proportion of positive associations and a decreasing proportion of negative associations were reported, as one moved from high levels of SES development in countries with medium to low development,[40] though findings varied by economic indicator for example education and occupation were the main drivers for body size in women from highly developed countries as compared to income and material possessions for low to medium developed countries.[40]

HFCE per capita has increased in South Africa, this indirectly highlights improved food security in many households and increased marginal propensity to consumption. As this increases, obesity levels have also increased attributable to increased energy and fat intake as diets in South Africa become more westernised.[11] In South Africa, economic growth has significantly led to technological changes that have improved the quality of lives for many. However, evidence exists that suggests that technological change has induced weight growth by making home and market production more sedentary and by lowering of food prices through strong subsided agricultural innovations[24] ultimately increasing HFCE. Whether technological change

has simultaneously raised the cost of physical activity and lowered the cost of high dense caloric foods in South Africa needs further investigating.

The poor in LMICs including South Africa have over the years been protected against obesity and the rich more susceptible. This is attributable mainly to food scarcity and food insecurity especially among the poor. The poor have always tended to do more manually involving occupations with a higher expenditure for energy as compared to the rich.[21] Additionally in LMICs, larger body size is associated with wealth, health and a positive status signal.[41] In higher income countries, food security is not largely an issue, instead access to healthy foods is more critical issue distinguishing the more affluent from the less affluent.[21] Healthier foods are likely to be expensive for the poor thus resulting in lower consumption levels and a diet dominated by high energy dense foods.[42] In a South African rural study, healthier diets cost between 10-60% more when compared with what they consumed commonly.[43]

The trend associations for both genders between the Gini coefficient for all ethnicities and obesity prevalence were similar in that as the Gini coefficient increased obesity prevalence declined, and when the coefficient decreased obesity prevalence increased. This coefficient which represents income inequality had a surprisingly negative trend association with obesity prevalence. A vast literature exits that suggest an opposite association as reported in this study.[44,45] The positive associations between Gini coefficients and obesity are mainly attributed to income inequalities acting as an ecological stressor thus impairing well-being.[46] This has been shown to alter eating habits and behaviour in favour of non-prudent diets that are calorie dense.[47,48] Additionally this induced stress triggers several psychological and biological mechanisms that ultimately increase obesity risk.[49] In an Indian study, mimicking South Africa in that they also experience both under and over nutrition, using adjusted models, an increase in income inequality significantly increased the risk of both underweight and being obese in adults.[45] As for the negative trend observed in this study between Gini coefficients and obesity, this can be explained in that the coefficients changed marginally over the years and as Gini coefficients decrease, those previously in the lower end potentially have more assess to food and improved HFCE.

Economic growth in South Africa relates with other known determinants of obesity (i.e. diet quality and physical activity patterns). Rapid changes in in South Africa have improved technology, equity, and transport systems. The food environment has over the years changed as more food becomes available due to improved agriculture outputs stemmed by high and sophisticated mechanisation. More robust methods to understand this challenge including improved, validated and standardised dietary and physical activity methodologies are needed and should be incorporated in national surveys.[14] A great need exists for short and long term innovative strategies that are country specific to slow or steer this transition in a different direction as economic growth will remain a priority for the country.

The strengths of this study include having data over a longer time frame, and data being available on multiple ethnicities by gender. The limitations of this study include not being able to link EGIs with obesity at individual level. Thus other confounding factors that are known to influence obesity status cannot be adjusted for in the analysis. BMI was used as a proxy for obesity in this analysis, though it has great validity it however, does not intrinsically capture or define body composition in terms of whole body compartments. Additionally evidence exists that suggest that BMI may overestimate obesity prevalence among woman of lower SES.[50] GDP per capita as a measure of welfare is limited in that it assumes equal distribution of wealth across the population implying the lack of inequality and Gini coefficient measures relative not absolute wealth. As for HFCE household expenditure surveys do not cover the whole population, it is with respect to a reference person that the relationship of other household members is determined and this can be biased. In conclusion, we highlight and illustrate that trend associations between South Africa's economic growth with adult obesity prevalence between 1994 and 2014 exits. The increasing concerns for South Africa related to this increased burden of obesity and NCDs, are whether the current health systems and infrastructure will cope, thus prevention seems the only way for South Africa.

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