

THE SOCIOECONOMIC DETERMINANTS OF OBESITY IN NIGERIA

Mohammed Nuhu

Department of Economics, Faculty of Social Sciences, University of Benin, Benin City, Edo State.

Email: Nuhu.mohammed@uniben.edu

ABSTRACT

The ongoing demographic and epidemiologic transitions in Nigeria are some of the possible reasons why the prevalence of obesity is increasing in Nigeria. Also, the economic impact of obesity in Nigeria results to a decrease in productivity. Policies have been put in place by the federal government to reduce the prevalence of obesity in Nigeria. However, the nature and magnitude of policies put in place are important to note. It is based on this premise that the study of socioeconomic determinants of obesity in Nigeria was carried on. The simultaneous equation model was used to analyse the study with a cross sectional data sourced from the demographic and health survey 2019. A dummy variable was created to represent the regions in Nigeria. The result established that the socioeconomic determinants of obesity in Nigeria are wealth index, occupation, region, gender and frequency of watching television. Wealth index has a positive impact on body mass index. The study also investigated whether obesity varies across geopolitical zones in Nigeria and it was discovered that region has a greater impact on body mass index as it varies significantly across regions. All other regions have a higher body mass index except the regions of North West and South West. It was found that individuals from the North East, South South and South East have higher body mass index than those who live in North Central, North West and South West. The study therefore recommends that efforts should be made by the government to ensure an equitable distribution of wealth and also create awareness on the need for a proper healthy lifestyle. Also, individuals whose occupations are prone to increased body size should engage in regular physical exercise.

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1. BACKGROUND TO THE STUDY

Obesity is an excessive or abnormal fat accumulation that may impair health if drastic actions are not taken. (Ellulu, Abed, Rahmat, Ranneh and Ali (2014). It is a deadly non communicable disease which is gaining increasing importance globally and emanates as a result of excessive food intake containing fats, sugar dense meals and reduction in physical activities. Also, obesity occurs, as a result of an imbalance between energy intake and energy output leading to the accumulation of fats in the body (Thiam, Samba, Lwanga, 2006). The World Health Organisation (WHO, 2014) states that Obesity is an abnormal or excessive fat accumulation that may impair health which occurs in individuals with body mass index greater than 25 kilogram per metre square (kg/m^2) for overweight individuals and a body mass index greater than 30 kilogram per metre square (kg/m^2) for obese individuals. The WHO went further to state that these cut-off points provide a benchmark for individuals assessment.

Studies carried out in Nigeria by (Abubakari, A., Lauder, W. Agymang, C., Jones, M., Kirk, A and Bhopal, R., 2008; Iloh, G., Amadi, A, Nwankwo, B., & Ugwu V., 2011; Chinedu, S., & Emiloju O., 2014; Onyechi, U. & Okolo, A. 2008) found out that a higher prevalence of obesity exist among women by 62.0% compared with men by 41.9% and research carried out in the South Western part of Nigeria also shows a higher obesity prevalence of 28% in women compared to 21% in men (Kadiri, S. & Salako B., 1997). The higher prevalence of obesity among the women may be attributed to physical inactivity than males, changes in the energy density of diets, sedentary life style. To buttress this claim, Wahab Sani, Yusuf, Gbadamosi & Yandutse (2011) observed that women from the Northern part of Nigeria are engaged in sedentary life style, they also noted that there are women who never worked but preferred being full house wives and engagement in physical exercise is not a common activity in the general population of the North. The prevalence of obesity has greatly affected the Nigerian economy as there are no adequate measures taken in creating awareness and reorientation

programmes by health based action group in collaboration with the government to educate consumers on proper food intake and health maintenance thereby leading to a decrease in output per capital (Ekpenyong & Akpan, 2013).

2. THEORETICAL LITERATURE

This study shall review health production function theory, social capital and health and psychosocial approach theories that relates to the socioeconomic determinants of obesity.

2.1 HEALTH PRODUCTION FUNCTION' THEORY

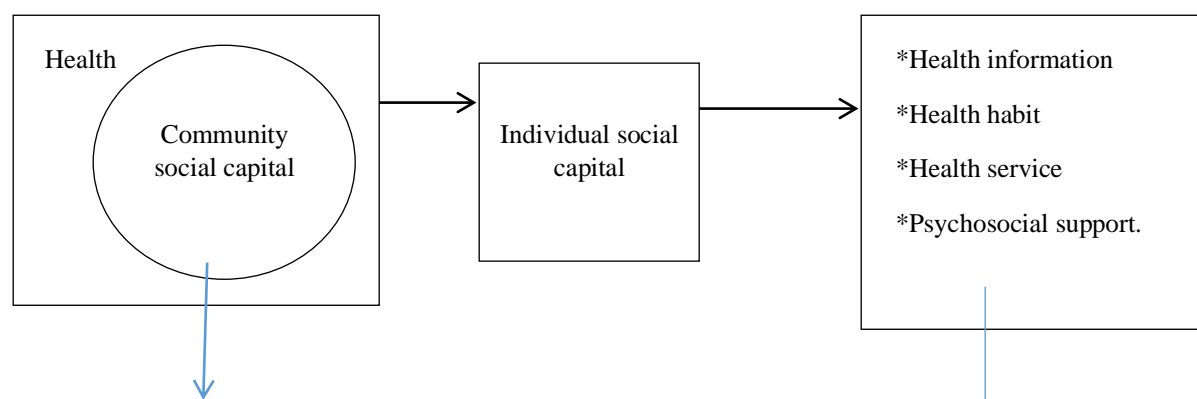
Health production function theory explains the maximum output of health that can be produced out of a given combination of inputs such as health care. Health depends on a number of factors some of which can be influenced by the individual himself. Hence health can be produced by a number of different inputs such as food, immunizations, use of uncontaminated water, curative medical care that complements in producing good health. Households combine purchased goods and services with the time and know-how of household members to produce increments in health. According to Davanzo & Gertler (1990), Individuals and households characteristics may also influence the ability to combine health inputs appropriately, and therefore the effectiveness with which they are used. Education in particular affects the ability to understand and use inputs effectively to influence health because the ability to follow treatment plans is crucial for the treatment to improve health. Grossman (1972), model for health demand provides insight into the relationship between health, human capital and consumption at the individual level, as well as a frame work for human capital accumulation and its relationship to productivity at micro and macro levels. This theory brings insight into two key aspect of human capital such as health and education and their relationship to labour supply, earnings and productivity.

Resources must be available for individual to use health facilities even though they are predisposed to using them. Babisch et al (2012) has it that community/organizational and personal/family enabling resources must be present for use to take place. Community resources entail structures and distribution of health facilities and personnel. It also involves physician and hospital density, office hours, provider mix, quality management oversight, and outreach and educational programmes. People must have the resources and the know-how to gel to these services and make use of them. Income, health insurance, a regular source of care, and travel and waiting times are some of the measures that are included in this category (kimani, 2014). Andersen and Davidson (2001) at the individual level differentiate between perceived need for health services and evaluated need. Perceived need relates to how people view their own general health and how they experience symptoms of ill less, pain, and worries about their health. It also incorporates whether or not they judge their problems to be of sufficient magnitude to require professional help. Evaluated need represents professional assessments and objective measurements of patients' health status and need for medical care. At the community level a distinction is made between environmental need characteristics and population indices. Environmental need characteristics include occupational and traffic, crime related injury and death rates. Population indices on the other hand include overall measures of community health including epidemiological indices indicators of mortality, morbidity and disability (Andersen, 1995: Anderson & Davidson, 2005; Anderson & Newman, 2001).

2.2 SOCIAL CAPITAL AND HEALTH

The health of household members is associated with the social structure in which the household is found. Social capital in this context is the capacity to command resources by virtue of being member of a wider social structure. Rutherford & Vasarhelyi, (2006) posits that these social structures consist of friends, family and co-workers, organizations such as churches, recreational organizations and political organizations. These networks provide platform for people to receive support and work towards achieving common goals. Social capital is either a community level or individual level source. It is used to achieve common goals that could not be achieved if the individual is operating alone. While personal social networks are used to strengthen social support, social influence, social engagement, attachment and access to scarce resources (Fortes, 1998). At the individual level it can be measured as the number or presence of friends, membership in a formal or informal group, trust and sense of control over one's health.

Nauenberg, Laporte&Shen (2009) suggested the pathway through social capital affect health care utilization



Source: Nauenberg et al (2009)

Knowledge about how to cure or prevent disease: and increase awareness that treatment is needed or adoption of good health habit may be made possible through contacts with friends and relatives, participation in social events and meetings and membership of formal or informal organizations (Nauenberg et al, 2009).

2.3 PSYCHOSOCIAL APPROACH

This theory is of the view that people's perception and experience of personal status in unequal societies leads to stress and poor health. To support this claim, Classel, (1976) argued that stress from the "social environment" causes a negative effect on individual feelings which affects the nervous system causing an increase in individual's vulnerability to disease. According to theory, the experience of inequality forces an individual to compare their positions with others thus posed with feelings of shame and inferiority complex undermines the health of an individual. At the society level, a fall in income and social status weakens social unity and causes a disruption of social bonds which is detrimental to health. Christopher, (2009) argued that poor health during childhood is associated with lower educational attachment, low socioeconomic status and more health problems in adulthood.

Amidu et al. (2013) carried out a study to access the prevalence of childhood overweight/obesity and its association with type of school (private & public), parental education and other life style factor among school children between the ages of 6-12 years in tamale metropolis of Ghana. Findings from the researchers shows that the prevalence of childhood overweight and obesity were 9.8% and 7.5% respectively and was higher in children from private schools than children in public schools as supported by (Al-Hazzaa, Abihussain, Al-Sobayel, Qahwaji and Musaiger, 2012) who attributed obesity to factors such as parents or guardians with high level of education and the luxury of children being driven to school in cars unlike children from low socioeconomic households who walk to school as supported by Bascetta, (2005). In addition, ChatwalVerma and Riar (2003) found out that declines in physical activity and sedentary life style has led to the prevalence of obesity amongst children through displacement of physical activity, increased caloric consumption while playing games or watching television and reduced basal metabolism. Amoah, (2003) also attributed the cultural predisposition of Ghanaians towards obesity as a sign of wealth, beauty and wellbeing.

2.4 Empirical Literature Within Nigeria

The empirical findings on the link between the emergence of obesity among Nigerians and the sedentary life style and wellness in Nigeria by Anthony & Adebamowo (2014) conducted a cross sectional study to examine leisure-time physical activity levels among African adults in an urban setting using a random sample of 1058 adults at a government worksite in Abuja, an urban Nigerian city. The researchers made use of log binomial regression models to estimate the multivariable adjusted associations of the correlates of physical activity and found out that more than 80% of urban professional Nigerians do not meet the world health organization recommendations of physical activity. Urbanized Africans in this study population had low levels of leisure-time physical activity, independent of age, sex and body mass index which has major implications for the prevalence of non-communicable disease in this population. Similarly, Raheem, Ali and Adekeye (2010), carried out a research on the differences in the sedentary life style of rural and urban people of Kaduna state, Nigeria using the descriptive and inferential statistics. The findings from the research shows that the urban people of Kaduna state are more engaged in sedentary life style than their rural counterparts as the use of mobile phones, automobiles, air conditioners and household gadgets in the urban areas has increased the sedentary life style in that area while their rural counterparts depends largely on working and bicycling as their means of transportation.

Okafor, Gezawa. Sabir, Raimi and Enang (2014) undertook a comprehensive study to evaluate the overall burden and pattern of abnormal weight distribution among healthy urban dwelling Nigerians and to evaluate if there are regional differences across sections. A community based descriptive survey was carried out in five urban cities using the World

Health Organization, (WHO) step wise methodology. Based on their findings, it was concluded that the greater prevalence of overweight/obesity may be seen among rural dwellers as a result of reduced physical activities and consumption of energy and fat laden diets. Abnormality of weight affected more females than males. Similarly, Akaralo et al. (2012) argued that there are regional variations in the type of bolus meals consumed by Nigerians with greater consumption of rice and maize based meals in the north and consumption of yam and cassava based meals in the south.

Chukwunoye, Abali, Ikechi and Ugochukwu (2013) conducted a cross sectional survey in Abia state, south east Nigeria to evaluate the association between socioeconomic status and obesity, using income and education as independent determinants. A total of 2487 Adults took part in the study. 97% of participants who took part in this study are Igbo's since the state is predominantly inhabited by that ethnic group. A direct relationship 'vas observed between income and obesity in both men and women. In the combined group of men and women, the prevalence of obesity in low, middle and upper income class was 12.2%, 16% and 20% respectively. The prevalence of obesity in those with no formal education, primary, secondary, and tertiary education in the combined group was 6.3%, 14.9%, 10.7% and 17.7°/c respectively. The binary regression analysis showed that educational status is a predictor of obesity among all respondents, the odds of being obese were found to be 31% or higher among women with higher educational status; on the other hand, higher income level was found to increase the odds of obesity by 57%, 60% and 35% among men, women and all participants respectively. Mbada et al (2009), found socioeconomic status to be inversely related to weight. The result of the researchers points clearly to a link between socio demographic factors and obesity in southeast Nigeria. The researchers also states that there is a need to increase awareness of obesity and related complications in this population as efforts to combat obesity through exercise and nutritional awareness programmes are needed.

3. THEORETICAL FRAMEWORK

This study intends to adopt the Eco-Social theory of social determinants of health propounded by Krieger (1994). The theory lays emphasis on describing and explaining casual relationships in disease distribution and social inequality in health. Eco-social approach has tried to integrate social and biological reasoning and a dynamic, historical and ecological perspective to develop new insights into determinants of population distribution of disease and social inequalities in health. An application of eco-social theory shows that people with lower socioeconomic position tend to have higher rates of obesity on average as do populations of African, Americans, some Hispanics and American Indians. This theory will help the study to examine how this social forces and pathways become incorporated into the physical outcome of obesity.

3.1 Model Specification

To explore the relationship between BMI and Wealth Index as reported in the DHS 2013 for Nigeria, the current study will employ a simultaneous equation model as a result of endogeneity. The modeling strategies draw on Stern (1989) in Cai (2012). The first equation describes the determination of obesity (BMI)

$$BMI = \alpha_0 + \alpha_1 WI + \alpha_2 OCC + \alpha_3 GENDER + \alpha_4 REG + \alpha_5 FWTV + \mu_i \text{-----(1)}$$

$$WI = \beta_0 + \beta_1 BMI + \beta_2 OCC + \beta_3 GENDER + \beta_4 FWTV + \beta_5 EDA + \mu_i \text{-----(2)}$$

Where:

BMI = Body Mass Index (Obesity)

WI = Wealth Index

OCC = Occupation

EDA= Educational attainment

REG= Region

FWTV = Frequency of Watching Television

Gender

U_i = disturbance term

Due to possible problem of endogeneity of the WI index variable, Educational Attainment will be used as an instrument for wealth index

3.2 PRE- ESTIMATION TEST

TESTING FOR IDENTIFICATION USING THE ORDER CONDITION

Where K. = total number of variables in a model

k= total number of variables in a given equation

m= total number of equations in a model

$$K-k=m-1$$

For equation 1

$$(7-6)-(2-1)$$

1 = 1 therefore equation 1 is just identified.

For equation 2

$$(K-k) = (m-1)$$

(7-6)- (2-1)

1 = 1 therefore equation 2 is just identified.

Table 1. THE RANK ORDER CONDITION

	BMI	WI	occ	GENDER	REG	EDA	FWTV
Equ 1	1	α_1	α_2	α_3	α_4	0	α_5
Equ 2	β_5	1	β_2	β_3	0	β_1	β_4

Using the (m-1) (m-1) matrix determinant= β_1 in equation 1 and α_4 in equation 2 are identified. From the above, we shall generate the reduced form equation of simultaneous equation model for identification purpose. This means that equations, (1) and (2) have their dependent variables existing as explanatory variables in each equations, solving for the reduced form equation, we have;

$$BMI = \alpha_0 + \alpha_1 WI + \alpha_2 OCC + \alpha_3 GENDER + \alpha_4 REG + \alpha_5 FWTV + \mu_i \text{-----}(3)$$

$$WI = \beta_0 + \beta_1 BMI + \beta_2 OCC + \beta_3 GENDER + \beta_4 FWTV + \beta_5 EDA + \mu_i \text{-----}(4)$$

Where equations (3) and (4) are econometric transformations of equation (1) and (2) One can easily see that by the order condition both equations are Just- identified and the rank condition are also identified. (The order condition of identifiability requires that the number of predetermined variables excluded from the equation must not be less than the number of endogenous variables included in that equation less 1, that is: $K - k = m - 1$, where K is the number of variables in the model, k is the number of predetermined variables in a given equation and m is the total number of endogenous variables in a given equation.) (Gujarati & porter, 2009)

To determine the reduced equation for BMI implies substituting equation (4) into (3);

$$BMI = \alpha_0 + \alpha_1(\beta_0 + \beta_1 BMI + \beta_2 OCC + \beta_3 GENDER + \beta_4 FWTV + \beta_5 EDA + \mu_i) + \alpha_2 OCC + \alpha_3 GENDER + \alpha_4 REG + \alpha_5 FWTV + \mu_i \text{-----}(5)$$

$$BMI = \alpha_0 + \alpha_1 \beta_0 + \alpha_1 \beta_1 BMI + \alpha_1 \beta_2 OCC + \alpha_1 \beta_3 GENDER + \alpha_1 \beta_4 FWTV + \alpha_1 \beta_5 EDA + \alpha_1 \mu_i + \alpha_2 OCC + \alpha_3 GENDER + \alpha_4 REG + \alpha_5 FWTV + \mu_i \text{-----}(6)$$

Collecting like term gives

$$BMI = \alpha_1 \beta_1 BMI = \alpha_0 + \alpha_1 \beta_0 + \alpha_1 \beta_2 OCC + \alpha_1 \beta_3 GENDER + \alpha_1 \beta_4 FWTV + \alpha_1 \beta_5 EDA + \alpha_1 \mu_i + \alpha_2 OCC + \alpha_3 GENDER + \alpha_4 REG + \alpha_5 FWTV + \alpha_1 \mu_i + \mu_i \text{-----}(7)$$

Simplifying gives

$$BMI(1 - \alpha_1 \beta_1) = (\alpha_0 + \alpha_1 \beta_0) + (\alpha_1 \beta_2 + \alpha_2) OCC + (\alpha_1 \beta_3 + \alpha_3) GENDER + (\alpha_1 \beta_4 + \alpha_5) FWTV + \alpha_1 \beta_5 EDA + \alpha_4 REG + (\alpha_1 \mu_i + \mu_i) \text{-----}(8)$$

Divide though by $(1 - \alpha_1 \beta_1)$

$$BMI = \frac{\alpha_0 - \alpha_1 \beta_0}{\alpha_1 - \beta_1 \alpha_1} + \left(\frac{\alpha_1 \beta_2 + \alpha_2}{\alpha_1 - \beta_1 \alpha_1} \right) OCC + \frac{\alpha_1 \beta_3 + \alpha_3}{\alpha_1 - \beta_1 \alpha_1} GENDER + \frac{\alpha_1 \beta_4 + \alpha_5}{\alpha_1 - \beta_1 \alpha_1} FWTV + \frac{\alpha_1 \beta_5}{\alpha_1 - \beta_1 \alpha_1} EDA + \left(\frac{\alpha_4}{\alpha_1 - \beta_1 \alpha_1} \right) REG + \frac{\alpha_1 \mu_i + \mu_i}{\alpha_1 - \beta_1 \alpha_1} \text{-----}(9)$$

If we allow the following

$$\pi_{10} \left(\frac{\alpha_0 - \alpha_1 \beta_0}{\alpha_1 - \beta_1 \alpha_1} \right) + \pi_{11} \left(\frac{\alpha_1 \beta_2 + \alpha_2}{\alpha_1 - \beta_1 \alpha_1} \right) + \pi_{12} \frac{\alpha_1 \beta_3 + \alpha_3}{\alpha_1 - \beta_1 \alpha_1}, \pi_{13} = \frac{\alpha_1 \beta_4 + \alpha_5}{\alpha_1 - \beta_1 \alpha_1} \pi_{14} = \left(\frac{\alpha_1 \beta_5}{\alpha_1 - \beta_1 \alpha_1} \right)$$

$$\pi_{15} = \left(\frac{\alpha_4}{\alpha_1 - \beta_1 \alpha_1} \right) v_{10} = \left(\frac{\alpha_1 \gamma_1 \mu_1}{\alpha_1 - \beta_1 \alpha_1} \right)$$

the reduced form equation for BMI gives:

$$BMI = \pi_{10} + \pi_{11} OCC + \pi_{12} GENDER + \pi_{13} FWTV + \pi_{14} EDA + \pi_{15} REG + v_{10} \text{-----(10)}$$

Where π_{11} , π_{12} , π_{13} , π_{14} and π_{15} are the least square estimators. Equation 10 will be used to capture objective 1.

Solving for reduced form equation for WI gives;

Substitute equation (3) into (4)

$$WI = \beta_0 + \beta_1 [u_0 + u_1 WI + u_2 OCC + u_3 GENDER + u_4 REG + u_5 FWTV + \mu_i] + \beta_3 GENDER + \beta_4 FWTV + \beta_5 EDA + \gamma \text{-----(11)}$$

Expanding equation 11 gives

$$WI = \beta_0 + \beta_1 \alpha_0 + \beta_1 \alpha_1 WI + \beta_1 \alpha_2 OCC + \beta_1 \alpha_3 GENDER + \beta_1 \alpha_4 REG + \beta_1 \alpha_5 FWTV + \beta_1 \mu_i + \beta_2 OCC + \beta_3 GENDER + \beta_4 FWTV + \beta_5 EDA + \gamma \text{-----(12)}$$

Collecting like term gives

$$WI = \beta_0 + \alpha_1 WI = \beta_0 + \beta_1 \alpha_0 + \beta_1 \alpha_2 OCC + \beta_2 OCC + \beta_1 \alpha_3 GENDER + \beta_3 GENDER + \alpha_4 \beta_1 REG + \beta_4 FWTV + \beta_5 EDA + (\beta_1 \mu_i + \gamma) \text{-----(13)}$$

Factorizing equation 13 gives

$$WI (1 - \beta_1 \alpha_1) = [\beta_0 + \beta_1 \alpha_0] + (\beta_1 \alpha_2 + \beta_2) OCC + (\beta_1 \alpha_3 + \beta_3) GENDER + \alpha_4 \beta_1 REG + \beta_4 FWTV + \beta_5 EDA + (\beta_1 \mu_i + \gamma) \text{-----(14)}$$

Dividing through by $1-\alpha_1\beta_1$ gives

$$\begin{aligned}
 WI = & \left(\frac{\beta_0 - \beta_1\alpha_0}{1-\beta_1\alpha_1} \right) + \left(\frac{\beta_1\alpha_2 + \beta_2}{1-\beta_1\alpha_1} \right) OCC + \left(\frac{\beta_1\alpha_3 + \beta_3}{1-\beta_1\alpha_1} \right) GENDER + \left(\frac{\alpha_4\beta_1}{1-\beta_1\alpha_1} \right) REG \\
 & + \left(\frac{\beta_4}{1-\beta_1\alpha_1} \right) FWTV + \left(\frac{\beta_5 EDA}{1-\beta_1\alpha_1} \right) + \left(\frac{\beta_1\mu_1\gamma_1}{1-\beta_1\alpha_1} \right)
 \end{aligned}$$

If we allow the following

$$\begin{aligned}
 \pi_{20} \left(\frac{\beta_0 - \beta_1\alpha_0}{1-\beta_1\alpha_1} \right) + \pi_{21} \left(\frac{\beta_1\alpha_2 + \beta_2}{1-\beta_1\alpha_1} \right) + \pi_{22} \left(\frac{\beta_1\alpha_3 + \beta_3}{1-\beta_1\alpha_1} \right), \pi_{23} = \left(\frac{\alpha_4\beta_1}{1-\beta_1\alpha_1} \right), \pi_{24} = \left(\frac{\beta_4}{1-\beta_1\alpha_1} \right) \\
 v_2 = \left(\frac{\beta_1\mu_1\gamma_1}{1-\beta_1\alpha_1} \right) \dots\dots\dots(15)
 \end{aligned}$$

The reduced form equation for WI gives:

$$WI = \pi_{20} + \pi_{21}OCC + \pi_{22}GENDER + \pi_{23}REG + \pi_{24}FWTV + \pi_{25}EDA + v_2 \dots\dots\dots(16)$$

3.3 ESTIMATION PROCEDURE

3.3.1 Modeling BMI

We use equation 10 which is the reduced form equation of equation 3 to obtain the estimated values of WI (i.e WI). WI will be replaced in equation 3 with the estimated (WI) from equation 10 and estimate the indirect least square equation

$$BMI = c_0 + c_1WI + c_2OCC + c_3GENDER + c_4REG + c_5FWTV + \mu_1 \dots\dots\dots(17)$$

3.3.2 Modeling Wealth Index (WI)

To model wealth index we also use equation 16 which is the reduced form of equation 4 to obtain the estimated values of BMI BMI. The BMI in equation 4 will be replaced with the estimated BMI from equation 16 to estimate the ILs equation

$$WI = \theta_0 + \theta_1BMI + \theta_2OCC + \theta_3GENDER + \theta_4REG + \theta_5FWTV + \beta_5EDA + \mu_2 \dots\dots\dots(18)$$

To capture objective 2 of this study, we introduce a dummy for region from equation 10 which will lead us to the equation below. According to Gujarati (2007), in order to avoid a dummy variable trap we introduce five dummies for region using north central as a bench mark category so as to avoid the case of perfect colinearity

$$BMI = \pi_{10} + \pi_{11}OCC + \pi_{12}GENDER + \pi_{13}FWTV + \pi_{14}EDA + \delta_{13}REG_1 + \delta_{14}REG_2 + \delta_{15}REG_3 + \delta_{13}REG_4 + \delta_{13}REG_5 + \mu_1 \dots\dots\dots(19)$$

- Therefore, Equation 19 will be used to capture objective 2
- Where REG₁ takes the value for 1 if north east, 0 otherwise
- Where REG₂ takes the value for 1 if north west, 0 otherwise
- Where REG₃ takes the value for 1 if south east, and 0 otherwise
- Where REG₄ takes the value for 1 if south west, 0 otherwise
- Where REG₅ takes the value for 1 if south south, 0 otherwise

4. PRESENTATION AND ANALYSIS OF RESULTS

This section presents the description of the variables and analysis

Table 2. Description of Variables

VARIABLES	OBS	SUM	MEAN	STD. DEV.	MIN	MAX
BMI	8574	2.09	2414.58	947.52	1266	9999
WI	8574	25000	2.89	1.43	1	5
OCCUPATION						
0. Networking	8574	75	0.01	0.21	0	1
1. Prof/Tec/Mag	8574	1073	0.12	0.33	0	1
2. Clerical	8574	71	0.01	0.09	0	1
3. Sales	8574	1515	0.17	0.38	0	1
4. ASelemp	8574	538	0.06	0.24	0	1
5. AgriEmp	8574	2757	0.32	0.47	0	1
6. Housemaids/dom	8574	2	0.00	0.01	0	1
SERVICES						
7. Skiid Manual	8574	1711	1	0	1	1
8. Unskild Manual	8574	389	0.04	0.21	0	1
96. Others	8574	6	0.01	0.03	0	1
EDUCATIONAL ATTAINMENT						
0. No Education	8574	3942	0.45	0.50	0	1
1. Incomplete Pri	8574	492	0.10	0.30	0	1
2. Complete Pri	8574	1271	0.15	0.35	0	1
3. incomplete Sec	8574	889	0.10	0.30	0	1
4. Complete Sec	8574	1412	0.16	0.37	0	1
5. Higher Edu	8574	648	0.07	0.26	0	1
GENDER						
1. Male	8574	8481	0.98	0.12	0	1
2. Female	8574	139	0.02	0.12	0	1
FMTV						
0. Not At ail	8574	4108	0.48	0.50	0	1
1. Lss Than Once	8574	1627	0.19	0.39	0	1
2. Atleast once	8574	2839	0.33	0.47	0	1
REG						
1. NOTC	8574	1399	0.16	0.37	0	1
2. NOTE	8574	1707	0.19	0.40	0	1
3. NOTW	8574	2805	0.33	0.47	0	1
4. SOE	8574	513	0.06	0.24	0	1
5. SOS	8574	1037	0.12	0.33	0	1
6. SOW	8574	1113	0.12	0.34	0	1

Source Demographic and Health Survey, 2013

Note: BMI= body mass index, WI= Wealth Index, ProtecMag = Professional/Technical/Managerial/, Aselemp = Agricultural Self Employed, AgriEmp= Agricultural Employed. Skilled Manual, Not working, NOTC - North Central, NOTE = North East, NOTW =North West, SOE = South East, SOS = South South and SOW = South West. The result from table 2 above showed that, the total observation for the study was 8574. Out of which body mass index has a mean of 2415.951, t standard deviation of 951.1602 and ranges from 1266 to 9999, Likewise, Wealth Index has a mean of 2.8910666, a standard deviation of 1.431 and ranges from 1 to 5. Also, the population of those not working that participated in the survey is 75 with a mean of 0.009, those who engage in sales are 1515, with a mean of 0.1753, while those who engage in Agricultural Self-employed are 538, etc.

4.1 Results and Interpretation

OLS = Ordinary least square

IV = instrumental variables

IV (robust) = This is used to check for the presence of

GMM = Generalized methods of moments heteroscedasticity in a model

Table 3. Result for the Social Economic Determinants of Obesity in Nigeria

Dependent Variable : BMI 1 = Body Mass Index

VARIABLE	OLS	IV	IV(Robust)	GMM
WI	72.79 11.6 (0.00)	149.23 29.39 (0.00)	149.23 28.08 (0.00)	166.47 27.71 (0.00)
Occ				
Pro/tec h/mag	181.91 112.70 (0.10)	145.31 113.59 (0.20)	145.31 48.53 (0.00)	141.66 49.03 (0.00)
Clerical	94.86 155.89 (0.54)	71.26 156.32 (0.64)	71.26 63.76 (0.26)	66.69 64.49 (0.30)
Sales	207.78 111.22 (0.06)	206.48 111.37 (0.06)	206.48 49.11 (0.00)	207.08 49.13 (0.00)
Aselfemp	107.21 116.64 (0.35)	177.13 119.38 (0.13)	177.13 60.63 (0.00)	193.77 60.65 (0.00)
Agricemp	128.89 110.45 (0.24)	179.54 112.03 (0.10)	179.54 47.59 (0.00)	182.87 48.04 (0.00)
Housemaid/domestic	-255.03 673.97 (0.70)	-289.63 674.99 (0.66)	-289.63 213.26 (0.17)	-302.05 218.96 (0.16)
Services	184.69 116.86 (0.11)	169.96 117.13 (0.14)	169.96 56.04 (0.00)	168.18 56.51 (0.00)
skilled manual	149.40 111.00 (0.17)	144.31 111.16 (0.19)	144.30 45.90 (0.00)	145.12 46.08 (0.00)
Unskilled manual	26.81 118.66 (0.82)	47.29 119.04 (0.69)	47.29 47.95 (0.32)	46.25 48.44 (0.34)
Other	253.46 398.90 (0.52)	215.86 399.66 (0.58)	215.86 58.49 (0.00)	208.13 56.99 (0.00)
GENDER				
Female	-59.909003 81.392182 (0.46)	-47.02505 81.629648 (0.56)	-47.02505 66.270538 (0.47)	-37.10 65.94 (0.57)
REG -				
NOTE	50.49 35.91 (0.16)	106.57 41.05 (0.00)	106.57 38.54 (0.00)	104.34 38.55 (0.00)
NOTW	-82.44 33.07 (0.01)	-29.50 38.03 (0.43)	-29.50 35.10 (0.40)	-17.20 34.34 (0.61)
SOE	127.13 49.16 (0.01)	111.22 49.55 (0.02)	111.22 52.09 (0.03)	96.63 49.92 (0.05)

SOS	104.68 40.36 (0.01)	90.90 40.70 (0.02)	90.90 37.55 (0.01)	91.45 37.05 (0.01)
SOW	-46.02 39.23 (0.24)	-79.54 41.03 (0.05)	-79.55 30.05 (0.00)	-92.26 29.78 (0.00)
FWTV				
Less than once a week	-38.89 31.93 (0.22)	-111.16 40.91 (0.00)	-111.16 38.48 (0.00)	-133.84 37.69 (0.00)
Atleast once a week	2.44 32.97 (0.94)	-91.16 46.72 (0.05)	-91.16 42.07 (0.03)	-113.17 41.38 (0.00)
Constant	2066.48 1 1 7.06 (0.00)	117.06 139.20 (0.00)	1853.85 91.93 (0.00)	1810.52 91.33 (0.00)

Estimated by the Author using Stata 13. Probability value in parenthesis at 5%

The result presented on table 2 above showed that the socio economic determinants of obesity are wealth index, occupation, gender and frequency of watching television. Table 3 showed a comparison among OLS estimate, IV estimate and GMM estimate, while the OLS estimate shows that an increase in wealth index by one unit, increases body mass index by 72.8 percent holding other factors constant. This same positive relationship was discovered in both the IV estimate and the GMM estimates except that while the IV estimate indicated 149.23 percent increase in body mass index for a unit increase in wealth index, the GMM estimate showed 166.47 percent increase in body mass index for a unit increase in wealth index. However, it must be noted that the GMM result may be plausible due to the potential presence of heteroscedasticity in the model. The interpretation of these results will focus on GMM. Also, the result of the GMM on table 5.2 above, equally showed an individual who worked in a professional/technical/ managerial position is most likely to have a body mass index that is 141.66 percent higher than an individual who is not working. The probability value of 0.004 which is less than the maximum significance probability value of 0.03 showed that the result is significant. This showed that an individual who worked in a professional/technical /managerial position will significantly have a high body mass than an individual who is not working. Likewise, it is shown that a clerical officer will likely have a predicted body mass index that is 66.69 percent higher than a person who is not working, however, this difference is not statistically significant, since it has a probability value of 0.30.

More so, a sales person will significantly have a body mass index that is 207 percent higher than one who is not working; this is significant with a probability value of 0.000, similarly, an individual who is in agricultural self-employment will likely have a body mass index that is 193.8 percent higher than one who is not working. While an individual who is in agricultural employment will significantly have a body mass index that is 182.87 percent higher than one who is not working. However, housemaids and domestic workers have an insignificant body mass index that is 302.1 less than one who is not working. Then again, the result indicated that those who work in service industries have on average body mass index that is 168.18 percent significantly higher than those who are not working holding every other factor constant. Also, a skilled manual worker equally has a body mass index that is 145.1 percent significantly higher than one who is not working. Whereas, an unskilled manual worker has a body mass index that is 46.26 percent insignificantly higher than a non-worker. Finally, those who are in other paid employment net listed were likely to have body mass index that is 208.13 percent higher than those who are not working.

For the variable Gender, the result indicated that being a female reduces the body mass index by 37.1 than being a male. However, this result is not statistically significant since the probability value of 0.574 is greater than the maximum significance probability value of 0.05. Going further, for the Frequency of Watching Television variable, the result indicated that those who watch television less than once a week will likely have body mass index that is 133.8 points less than those who do not watch TV at all, while those who watch television for at least once a week will likely have a body mass index that is 113.18 percent less than those who do not watch television at all and this difference which is statistically significant. However, these results do not meet apriori expectation.

Table 4. Result to show if Obesity Vary Across Geopolitical Zone in Nigeria

REG	OLS	IV	IV (Robust)	GMM
NOTE	50.49	106.57	106.57	104.34
*	35.91 (0.16)	41.05 (0.00)	38.54 (0.00)	38.55 (0.00)
NOTW	-82.44 33.07 (0.01)	-29.51 38.03 (0.43)	-29.51 35.11 (0.40)	-17.21 34.34 (0.61)
SOE	127.13 49.16 (0.01)	111.22 49.55 (0.02)	111.22 52.09 (0.03)	96.63 49.92 (0.05)
SOS	104.68 40.36 (0.01)	90.90 40.71 (0.02)	90.90 37.55 (0.01)	91.45 37.05 (0.01)
SOW	-46.02 39.23 (0.24)	-79.55 41.03 (0.05)	-79.55 30.05 (0.00)	-92.26 29.78 (0.00)

Source: Estimate by the author using Stata 13

The table 4 above provided answer to the objective two of the study where it seek to investigate whether obesity vary by geopolitical zones in Nigeria. From the result on table 5.3, it could be observed that a person who hails from the North Eastern part of Nigeria will likely have a body mass index that is 104.34 percent statistically significant with probability value of 0.007 less than an individual from the North Central holding other factors constant. On the other hand, an individual who is from North West will have a body mass index that is 17.21 percent less than those from the North Central. Whereas, an individual from the South East will have a body mass index that is 96.64 points higher than those from the North Central. Coming from the South South increases the likelihood of increasing the body mass index by 91.45 more than those from the North Central holding all other factors constant and this is statistically significant. And finally, those from south west have a body mass index of 92.28 percent significantly lower than those from North Central.

4.2 Discussion of Findings

The result from this study revealed that wealth index had a significant effect on body mass index. This result agreed with apriori expectations and equally agreed with the findings of Chukwunoye, et al (2013). This has helped to confirm that wealth index is a socioeconomic determinant of obesity. By extension the wealthy in the society will likely have high body mass index. The result also indicated that one's occupation has a way of determining the individual's body mass index as can be indicated by the differences with the various occupations listed with those who do not work at all. Where the results were statistically significant except the result for those in clerical, housemaid and unskilled manual. This may be because individuals who engage in these three occupations are usually poorly paid. On the other hand, the result of Gender, does not agree with that of Abubakari et al, (2008), lion, et al (2001): Chinedu et al (2014) and Onyechi et al (2008) who all found a higher prevalence of obesity existing among women. While results from the regression analysis found a higher prevalence of obesity among men. The result of frequency in watching television does not agree with the apriori expectation of this study. Those who watch television ought to have higher body mass index than those who do not watch television at all. However, the result showed the reverse.

5. SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 Summary of Findings

This study is carried out to known the socioeconomic determinants of obesity in Nigeria. The study developed two objectives to guide the study and the objectives were structured in such a way that it investigated the socioeconomic determinants of obesity and whether obesity vary across geopolitical zones. The objectives of the study and the proposed analysis of the objectives made the study capture all relevant information needed in addressing the objectives of the study, the demographic and health survey 2013 was used for the analysis of this study. The simultaneous equation model was used to capture objectives of the study. From the findings of the study, it was discovered that the socioeconomic determinants of obesity in Nigeria are wealth index, occupation, region, gender and frequency of watching television. While wealth index had a positive impact on body mass index. This is in agreement with Chukwunoye, et al (2013) who found similar result in a cross section study of the south eastern Nigeria and that of NCIM, (2009); occupation also affects the body mass index of an individual from the findings. Though the result offender is not statistically significant, the result obtained revealed that men tend to have higher bod/ mass index than women. The finding also discovered that obesity vary across geopolitical zone

in Nigeria which show region with a greater impact on body mass index as it varies significantly across regions. Using the North Central as the bench mark, all other regions had higher body mass index except the regions of North West and South West. It was found that individuals from the North East, South-South and South East have higher body mass index than those who live in North Central, North West and South West.

5.2 Conclusion

This study carried out the socioeconomic determinants of obesity in Nigeria. This study was carried out because of the alarming increase in the rate of obesity in Nigeria and the economic impact of the increased rate of obesity. The study reviewed related literatures both theoretical and empirical and from there major socioeconomic factors of obesity were identified which include income (wealth index as a proxy to income), occupation, gender, region and frequency of watching television. As a result of endogeneity in the wealth index, educational attainment was used as an instrument for wealth index, therefore, instrumental variable estimation was the method of estimation. From the result of the analysis in this study and the summary of findings, the study concludes that wealth index, occupation, region and frequency of watching television are major socioeconomic determinant of obesity in Nigeria. Also, wealth index had a significant effect on body mass index; region had a greater impact on body mass index as it varies significantly across regions.

5.3 Recommendations

Based on the findings of the study, the following recommendations are made: Efforts should be made by the government to ensure an equitable distribution of wealth. This will go a long way in ensuring that wealth is not concentrated in few hands who will consume it wrongly. An equitable distribution of wealth will also help individuals from the low socioeconomic class gain access to consuming rich nutritional diets. Also, individuals that are prone to having higher body mass index due to the sit tight nature of their jobs should be encouraged to engage in regular exercise. Sensitization programmes should be encouraged by the government at all levels to educate the people on the need for a proper diet and maintenance of a healthy life style.

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