

## Social Determinants of Body Mass Indices of women of Child Bearing Age in Nigeria

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### Abstract:

**Background:** The Body Mass Index is a measure of nutritional status, which when abnormal can indicate the risk of developing diseases. The aim of the study is to determine the association between social determinants of health and the Body Mass Index among women aged 15 - 49 years in Nigeria.

**Methodology:** This was a secondary data analysis of the NDHS 2013 Kid Recode dataset. SPSS 23 statistical software was used to analyze the data. A p-value of  $\leq 0.05$  was considered statistically significant.

**Results:** The mean age of respondents was  $29.5 \pm 7.0$  years, with mean weight of  $64.1 \pm 7.5$  kilograms and mean height was  $1.64 \pm 0.67$  metres. The prevalence of underweight was 8.7%, while 18.3% were overweight and 7% were Obese. The predictors of underweight were Age Group 15-29 years: (OR= 1.6; 95% CI= 1.4- 1.7;  $P < 0.001$ ),

**Rural dwellers:** (OR= 1.8; 95% CI= 1.6- 1.9;  $P < 0.001$ ), Lack of education: (OR= 2.7; 95% CI= 2.4- 2.9;  $P < 0.001$ ), Islamic faith: (OR= 2.1; 95% CI= 2.0- 2.4;  $P < 0.001$ ), Not working and low Wealth Index: (OR= 2.4; 95% CI= 2.2- 2.6;  $P < 0.001$ ). The predictors of over nutrition were Age Group 30-49 years: (OR= 2.1; 95% CI= 2.0- 2.2;  $P < 0.001$ ), Urban dwellers: (OR= 2.5; 95% CI= 2.4- 2.6;  $P < 0.001$ ), Education: (OR= 2.8; 95% CI= 2.6- 3.0;  $P < 0.001$ ), Christian: (OR= 0.49; 95% CI= 0.47- 0.52), Ever Married: (OR= 2.4; 95% CI= 1.8- 3.0;  $P < 0.001$ ), Working: (OR= 1.4; 95% CI= 1.4- 1.5;  $P < 0.001$ ) and High Wealth Index; (OR= 3.5; 95% CI = 3.3- 3.8;  $P < 0.001$ ).

**Conclusion:** The determinants of abnormal BMI in Nigerian women are age, place of residence, level of education, religion, marital status, occupation and wealth index.

**Keywords:** Social determinants, Body Mass Index, Women

### I. Introduction

Social determinants of the health of any individual or group refers to the conditions in which they are born, live, grow, work, and age, and the wider set of forces and systems shaping the conditions of their daily life.<sup>1,2</sup> These conditions affect a wide range of health risks and outcomes including their nutritional status and other health outcomes. These social determinants include income and income distribution, level of education, housing and housing conditions, tribe, race, religion, cultural practices, existing policies, social support networks and many more.<sup>1-3</sup>

Social determinants have been acknowledged as a critical component of the post- 2015 Sustainable Development global agenda.<sup>1</sup> This needs to be addressed in a systematic manner by improved governance for health and development, adopt better policies for nutrition and ensure their implementation, monitoring the progress of strategies to combat malnutrition and promote accountability of stakeholders. The nutritional status of individuals is largely shaped by these social factors.<sup>1,4</sup> These circumstances are affected by the distribution of money, power and resources at global, national and local levels.<sup>1</sup> The social determinants are mostly responsible for health inequities found within and between groups of people.<sup>1,4</sup> Women are vulnerable and are largely affected by poor state of social determinants.<sup>2</sup> The low status of Nigerian women with regards to income, education and other social conditions could affect their nutritional outcomes. The Body Mass Index (BMI) is a tool for monitoring nutrition transition globally. It takes into account the height and weight, and gives an idea of whether a person is underweight, normal weight, overweight, or obese. BMI is a very good gauge of body fat and helps health professionals to assess the risk for chronic diseases.<sup>6,7</sup>

The double burden of disease is becoming a problem in many low- and middle-income countries.<sup>8</sup> While infectious diseases and under-nutrition continue to be a problem in these countries, risk factors of non-communicable diseases such as obesity and overweight are also emerging.<sup>9</sup> Therefore, under-nutrition and obesity co-exist within the same households, communities or countries.<sup>9</sup> These risk factors are associated with increased risk of morbidity and mortality.

The United Nations Food and Agricultural Organization estimates that about 795 million people are suffering from undernourishment globally between 2014 – 2016.<sup>10</sup> About 840 million people in the world were undernourished as at the year 2014, that is approximately one in nine of the world's population.<sup>10</sup> The

prevalence of undernourishment has fallen from 18.7% to 11.3% globally, and from 23.4% to 13.5% in developing countries between 2012 and 2014.<sup>10</sup> There is global inequity in access to food as about 2 billion people lack basic nutrients, particularly vitamins and minerals, while 1.3 billion people are overweight.<sup>11</sup> Among Nigerian women, a study which uses BMI of  $\leq 18.5 \text{ kg/m}^2$  as cut off point, found 11% to be undernourished.<sup>11</sup> Undernourishment in women of reproductive age predisposes them to increased susceptibility to infections, anaemia or micronutrient deficiency, short stature, greater risk of obstructed labour, increased risk of having low birth weight babies, still births or miscarriage, production of poor quality breast-milk and reduced productivity among other negative consequences.<sup>13</sup>

In 2008, 35% of adults (34% men and 35% of women) greater than 20 years of age were found to be overweight (BMI  $\geq 25 \text{ kg/m}^2$ ). Women were more likely to be obese than men in all WHO regions.<sup>12</sup> The study found the overall prevalence of overweight and obesity among Nigerian women as 25%. The adverse health effects of obesity on the health of women include an increased risk of metabolic syndrome; insulin resistance and type 2 diabetes mellitus; reproductive disorders such as menstrual abnormalities, polycystic ovarian syndrome (PCOS), uterine cancer in postmenopausal women; cardiovascular disease; gall stones; other cancers; bone and joint disorders and pulmonary diseases.<sup>13</sup>

The conceptual framework by United Nations Children Funds (UNICEF) on maternal and child nutrition shows that the nutritional status of mother and child is determined by unhealthy household environment, food insecurity, inadequate dietary intake and inadequate care and feeding practices.<sup>4</sup> These factors are largely influenced by the prevailing socio-economic conditions of the mother and child such as income, quality education, availability of land, technology, cultural practices, economic and political environment. The NDHS 2013 offers an opportunity to observe the association between social determinants of health and the nutritional status of the women in Nigeria. This study is therefore aimed at determining the nutritional status of mother and the social factors that affect their nutrition in Nigeria.

## **Methodology**

The study used secondary dataset of the 2013 Nigerian Demographic and Health Survey (NDHS) by the National Population Commission (NPC) of Nigeria. The survey obtained information on the demographic, socioeconomic and health status of women aged 15- 49 years and their children 0- 59 months in 38,522 households.<sup>11</sup>

## **Study design**

A cross sectional design was used during the NDHS 2013 which is the fourth edition in Nigeria. The survey was carried out nationally and it covered an entire population of people who were living in non-institutional residential areas of all states in Nigeria.

## **Sampling Technique**

A stratified three-stage cluster technique was used to select the 2013 NDHS samples.<sup>11</sup> The 36 states in Nigeria were divided administratively into 774 Local Government Areas collectively. The states were regrouped into six geographical zones and Plateau state was considered as part of the North Central zone. The localities which were subdivided into census enumeration areas (EAs) in the NDHS 2006 were later regrouped as cluster units in the NDHS 2013 representing the primary sampling units. The EAs used in NDHS 2006 were too small having an average of 211 residents (which was equivalent to 48 households). Several EAs per DHS cluster was used in NDHS 2013 and each cluster had a minimum of 80 households.

## **Data Collection Tools**

The household and woman's questionnaires were used to obtain information on social determinants and nutritional status of the women. The household questionnaire was a pretested structured interviewer-administered questionnaire which collected information on household characteristics of each person listed including age, sex, marital status, education, water source, type of toilet used, height and weight measurements for children 0 - 59 months of age and women aged 15 - 49 years. The woman's questionnaire was also a pretested structured, interviewer administered questionnaire which was used to collect information on all women between 15 - 49 years of age. It obtained information on the women's background characteristics, the women's work, and their husband's background characteristics.

The questionnaires were translated into Hausa, Igbo, and Yoruba; the three major languages in Nigeria.

**Dependent Variables:** The ratio of the weight to the height squared of the women was already available in the dataset as the BMI and was considered as the dependent variable. This was further classified in accordance with the WHO categorization of BMI as: Underweight or thinness when BMI is less than  $18.49 \text{ kg/m}^2$ ; Normal weight from  $18.5 - 24.9 \text{ kg/m}^2$ ; Overweight from  $25 - 29.9 \text{ kg/m}^2$ ; Obese I from  $30$  to  $34.925 \text{ kg/m}^2$ ; Obese II from

34.9 to 39.9kg/m<sup>2</sup>; and Obese III for BMI  $\geq$ 40.0kg/m<sup>2</sup>. Over nutrition was generally considered as BMI of greater than 25kg/m<sup>2</sup>.

**Independent variables:** These are the sociodemographic variables in the dataset which included the women's age, place of residence, highest educational level, religion, marital status, occupation and wealth index.

#### **Data Analysis:**

The dataset used for the survey was obtained as a SAV file which was saved in different forms. The Kid recode dataset was selected for this study and imported into SPSS version 20 statistical software. The variables included in the dataset were reviewed and those found relevant for this study were selected for data analysis. The sociodemographic variables of the women were represented as frequencies and tables. The association between the social determinants of mothers' health such as age, educational status, occupation and income, and the BMI which was measured as height and weight in the women was determined using bivariate and multivariate analysis and a p-value of  $\leq$ 0.05 was considered statistically significant.

#### **Ethical Consideration:**

Ethical approval was obtained from the Ethical and Research Review Committee of the Jos University Teaching Hospital. Written permission was obtained from NPC Ethical approval was obtained from the Ethical and Research Review Board or Committee of the Jos University Teaching Hospital. Written permission was obtained from NPC in order to use the information contained in the database of the NDHS 2013 survey.

## **II. Result**

### **Sociodemographic characteristics of the women**

A total of 31482 women from the Kid recode dataset were studied. The mean age of the women was 29.5 $\pm$ 7.0 years with a range of 15 to 49 years of age. The women between 15 - 29 years of age made up 52.0%. More women (67.1%) resided in the rural area, 53.1% had primary education as their highest level of education and majority (71.1%) of the respondents were working women (Table 1).

### **Nutritional Status of the Women**

The mean weight, height and BMI of the women were 64.1 $\pm$ 7.5Kg, 1.64 $\pm$  0.70m and 23.4  $\pm$  5.6 Kg/m<sup>2</sup> respectively. Majority of the women (66.1%) were of normal weight while 8.7% and 7.0% of the respondents were underweight and overweight/obese respectively (Table 3).

### **Association Between Social Determinants and the BMI (underweight vs. normal weight) of the Women**

Younger women between 15 to 29 years of age were significantly more predisposed to being underweight (10.3%) compared to the women who were between 30-49 years of age(6.9%). The place of residence was also observed to significantly affect the BMI of the women as a higher proportion of women residing in the rural areas (10.0%) were underweight. Women who were not educated were significantly more malnourished (12.6%) compared to those who had at least primary level of education (5.1%). The women of Islamic faith, those that were not working and those that belong to the poorer and poorest wealth index had a higher prevalence of underweight (11.7%, 11.1% and 12.3% respectively).These associations observed were all statistically significant(Table 4).

### **Association Between Social Determinants and the BMI (Normal weight vs. Overweight/Obese) of the Women**

A higher prevalence of overweight and obesity was observed among women who were: between 30-49 years (35.4%); urban dwellers(40.6%); educated(36.5%); Christians (36.1%); ever married (28.1%); working (29.7%); and of the middle, richer and richest wealth index category (39.3%)(Table 5).These associations observed between sociodemographic variables and BMI were statistically significant.

### **Predictors of underweight among Respondents**

The probability of being underweight was 1.6 times more among women between the age of 15 to29 years (OR=1.6; 95%CI=1.4-1.7;P<0.001) than those between 30 to 49years of age. Women who lived in rural areas had a 1.8 times odds of developing underweight (OR=1.8; 95%CI=1.6-1.9; P<0.001) than those residing in urban areas. Uneducated women were almost 3 times more likely to be underweight when compared to those with at least primary education (OR=2.7; 95%CI=2.4-2.9; P<0.001). Islamic faith, unemployment and wealth index were also positively strong predictors of underweight in women (Table 6).

### **Predictors of Overweight and Obesity among Respondents**

Women between the age of 15 and 29 years of age were 1.6 times more likely to be underweight compared to women between 30 and 49 years of age (OR=1.6; 95%CI=1.4-1.7; P <0.001). Similarly, urban dwellers are more predisposed to overweight and obesity compared to rural dwellers (OR=2.5; 95%CI=2.4-2.6; P<0.001). The respondents who had at least primary education had 2.8 times odds of being overweight and obesity when the uneducated were used as the reference category (OR=2.8; 95%CI=2.6-3.0; P<0.001). Christians were less likely to be overweight and obese when compared to the Muslim women (OR=0.49; 95%CI=0.47-0.52). The women who had been married before or still married were 2.4 times more likely to be overweight and obese. Working (1.4; 95%CI=1.4-1.5; P <0.001) and High Wealth Index (OR=3.5; 95%CI = 3.3-3.8; P<0.001) were also predictors of over-nutrition (Table 6).

### **III. Discussion**

This study examined the relationship between some social determinants and the BMI of women in Nigeria. The result of this study showed that the prevalence of underweight, overweight, and obesity were 8.7%, 18.3% and 7.0% respectively. This finding is consistent with a review of the 2008 NDHS in Nigeria which found out that the prevalence of overweight and obesity among adult Nigerian women of reproductive age, was 18.1% and 7.1% respectively.<sup>14</sup> The NDHS 2013 also supports the findings of this study as the proportion of women who were underweight, overweight and obese were 11.0%, 17.0% and 8.0% respectively.<sup>11</sup> A study in Suburban Northern Nigeria determined that the prevalence of underweight, overweight and obesity were 10.0%, 18.0% and 22.0% respectively. The high prevalence of obesity observed in the study compared to this present study can be attributed to the location where the study was conducted as the study was in an urban settlement while this study was done in both rural and urban areas.

The present study revealed that younger women were more undernourished when compared to older women while the proportion of overweight and obesity rises as the age of the women increases. This study was corroborated by studies done in Nigeria which also showed that the prevalence of underweight reduces as age increases and obesity increases proportionately as age increases.<sup>15, 16</sup> Older women are more likely to have a better knowledge and experience about food availability and utilization when compared to the younger women and this may account for the differences observed.

Women who reside in the rural areas were at a higher risk of being undernourished compared to urban dwellers while obesity was higher among the urban dwellers. These findings are similar to studies in Ethiopia and India which showed that undernourishment was higher among rural women.<sup>18-20</sup> This rural-urban difference could be attributed to the low access to nutrition information, poor environmental sanitation and poor health seeking behaviour among rural women.

The educational status of the women was a strong predictor for both underweight and overweight/obesity among the women. This finding is consistent with studies that were conducted in Botswana, Ghana, Ethiopia.<sup>18, 21, 22</sup> This may be explained by the educated women have a better career opportunities and consequently, more wealth and nutrition. Additionally, the more educated a woman is, the more likely that she will be aware of the benefits of utilizing available resources for the improvement of nutritional status. Furthermore, educated women can make independent decisions and have access to household resources.<sup>20</sup>

Another significant predictor of BMI in this study was wealth index. The findings show that women in the poorest and poorer wealth index category were twice at risk of being underweight when compared to the women in the middle, richer and richest categories. Poverty is observed to affect the nutritional status of women through insufficient food intake and increased exposure to infections and lack of basic healthcare.<sup>23</sup>

Furthermore, women of the middle, richer and richest wealth index categories, were more than three times at risk of developing overweight/obesity. This finding is consistent with other studies conducted in Nigeria, Ethiopia, Ghana, Botswana.<sup>18, 21, 22</sup> This may be explained by the changing dietary pattern of wealthy urban dwellers who tend to adopt a western lifestyle by eating processed fast foods thereby consuming more calories.<sup>24</sup> Furthermore, richer people are involved in more sedentary pursuits with less physical activity which also increases the risk of developing overweight and obesity.<sup>25</sup>

### **Conclusion and Recommendations**

Women aged 15-29 years, rural dwelling, lack of education, Islamic faith, not working and low wealth index were found to be independently associated with under nourishment, while those aged 30-49 years, urban dwellers, education, Christian, ever married, working and have high wealth index are independently associated with overweight/obesity.

The prevalence of overweight and obesity especially in the rural areas indicates that the double burden of diseases, in this case underweight and malnutrition is slowly creeping into developing countries such as Nigeria. In the light of this, there is therefore an urgent need to mount intensive public health interventions which could be in the form of policies and actions that will:

1. Interrupt the intergenerational cycle of malnutrition in women by the creation of scaling up of nutrition programs targeted at women
2. Address micronutrient deficiencies in women
3. Create a database for BMI to act as a surveillance tool for monitoring nutrition transition in both men and women in Nigeria

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**Table 1:** Socio- demographic determinants

Variables	Frequency	Percentage (%)
<b>Respondent's age(years)</b>		
15 - 29	16376	52.0
30 - 49	15106	48.0
<b>Place of Residence</b>		
Urban	10351	32.9
Rural	21131	67.1
<b>Highest Educational Level</b>		
None	14762	46.9
At least Primary	16720	53.1
<b>Religion</b>		
Christian	12654	40.8
Islam	18354	59.2
<b>Marital Status</b>		
Never in union	604	1.9

Ever Married	30878	98.1
<b>Occupation</b>		
Not working	9099	28.9
Working	22383	71.1
<b>Wealth Index</b>		
Poorest & Poorer	14462	45.9
Middle, Richer & Richest	17020	54.1

**Table 2:** Descriptive Statistics of Respondents' Age, Weight, Height and BMI

Variables	Mean	Standard Deviation
Respondents' age (Years)	29.5	±7.0
Respondents' Weight (Kg)	64.1	±7.5
Respondents' Height (cm)	1.64	±0.70
Respondents' BMI (Kg/m <sup>2</sup> )	23.4	5.6

**Table 3:** BMI of respondents

BMI	Frequency	Percentage (%)
Underweight	2678	8.7
Normal weight	20440	66.1
Overweight	5657	18.3
Obese I	1459	4.7
Obese II	454	1.5
Obese III	249	0.8
Total	30937	100.0

**Table 4:** Relationship between social determinants and BMI(Underweight/Normal weight)

Variable	Underweight Frequency(%)	Normal Weight Frequency(%)	p-value
<b>Women's Age</b>			
15 - 29	1659(10.3)	14479(89.7)	
30 - 49	1019(6.9)	13840(93.1)	≤0.001
<b>Place of Residence</b>			
Urban	594(5.8)	9610(94.2)	
Rural	2084(10.0)	18709(90.0)	≤0.001
<b>Education Level</b>			
None	1829(12.6)	12669(87.4)	
At least Primary	849(5.1)	15650(94.9)	≤0.001
<b>Religion</b>			
Christian	521(4.2)	11961(95.8)	
Islam	2114(11.7)	15941(88.3)	≤0.001
<b>Marital Status</b>			
Never in union	58(9.8)	533(90.2)	
Ever Married	2620(8.6)	27786(91.4)	0.305
<b>Occupation</b>			
Not working	988(11.1)	7914(88.9)	
Working	1690(7.6)	20405(92.4)	≤0.001
<b>Wealth Index</b>			
Poorest& Poorer	1747(12.3)	12475(87.7)	
Middle, Richer, Richest	931(5.5)	15844(94.5)	≤0.001

**Table 5:** Relationship between social determinants and BMI(Overweight/Normal weight)

Variables	Normal Weight Frequency(%)	Overnutrition* Frequency(%)	p-value
<b>Women's Age</b>			
15 - 29	11496(79.4)	2983(20.6)	
30 - 49	8944(64.6)	4896(35.4)	≤0.001
<b>Place of Residence</b>			

Urban	5704(59.4)	3906(40.6)	
Rural	14736(78.8)	3973(21.2)	≤0.001
<b>Highest Educational Level</b>			
None	10508(82.9)	2161(17.1)	
At least Primary	9932(63.5)	5718(36.5)	≤0.001
<b>Religion</b>			
Christian	7638(63.9)	4323(36.1)	
Islam	12477(78.3)	7787(27.9)	≤0.001
<b>Marital Status</b>			
Never in union	457(85.7)	76(14.3)	
Ever Married	19983(71.9)	7803(28.1)	≤0.001
<b>Occupation</b>			
Not working	6105(77.1)	1809(22.9)	
Working	14335(70.3)	6070(29.7)	≤0.001
<b>Wealth Index</b>			
Poorest, Poorer	10245(84.5)	1877(15.5)	
Middle, Richer, Richest	9266(60.7)	6002(39.3)	≤0.001

\*Overnutrition = Overweight + Obese I + Obese II + Obese III

**Table 6:** Logistic Regression of Sociodemographics and BMI

Variables	Underweight		Overnutrition*	
	OR(95% CI)	p-value	OR(95% CI)	p-value
<b>Women's Age(years)</b>				
15 - 29	1.6(1.4-1.7)		1(Reference)	
30 - 49	1(Reference)	≤0.001	2.1(2.0-2.2)	≤0.001
<b>Place of Residence</b>				
Urban	1.8(1.6-1.9)		1(Reference)	
Rural	1(Reference)	≤0.001	2.5(2.4-2.6)	≤0.001
<b>Highest Educational Level</b>				
None	2.7(2.4-2.9)		1(Reference)	
At least Primary	1(Reference)	≤0.001	2.8(2.6-3.0)	≤0.001
<b>Religion</b>				
Christian	2.1(2.0-2.4)		1(Reference)	
Islam	1(Reference)	≤0.001	0.49(0.47-0.52)	≤0.001
<b>Marital Status</b>				
Never in union	1.1(0.9-1.5)		1(Reference)	
Ever Married	1(Reference)	0.301	2.4(1.8-3.0)	≤0.001
<b>Occupation</b>				
Not working	1.5(1.4-1.6)		1(Reference)	
Working	1(Reference)	0.004	1.4(1.4-1.5)	≤0.001
<b>Wealth Index</b>				
Poorest, Poorer	2.4(2.2-2.6)	<0.001	1(Reference)	
Middle, Richer, Richest	1(Reference)		3.5(3.3, 3.8)	<0.001