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Research Article

There is high prevalence of overnutrition among married and cohabiting women in Nigeria: Findings from the 2018 Nigeria Demographic and Health Survey

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Overweight and obesity are currently an epidemic affecting both developed and developing countries. Sub-Saharan Africa has a double burden of being underweight and obese and has recently been battling an alarming increase in the prevalence of overweight. This study investigates the predictors of overnutrition among married women of reproductive age in Nigeria using the socioecological model (SEM) as a framework, and hypothesized that the Southern region will have higher burden of overnutrition compared to the Northern region. The cross-sectionalstudy design was adopted using the 2018 Nigeria Demographic and Health Survey. A total of 8531 non-pregnant married women met the inclusion criteria. Bivariate logistic regression and hierarchical multilevel logistic regression models were fitted, which were informed by the socioecological model framework. The prevalence of overnutrition was 31%. When all covariates were fitted in a model, being older, being a Christian, having tertiary education, having an older partner with tertiary education, being wealthy, and living in a rural area were predictors of overnutrition at multivariate analysis. The predictive power increases as one moves from a lower to a higher level in the SEM - 24.9%, 25.5%, and 25.7% at the individual, interpersonal, and community/societal levels, respectively. Theprevalence of overnutrition among Nigerian married women is high, especially in the Southern region. Predictors of overweight are at all the SEM levels; however, it is better to consider all the levels when planning public health interventions.

1. Introduction

Overweight and obesity are currently an epidemic affecting both developed and developing countries [1]. Among people aged 18 and above in 2016, an estimated 2 billion and 650 million were overweight and obese, respectively [1][2][3]. Overweight contributes to 3.4 million mortality annually [4]. Sub-Saharan Africa has a double burden of being underweight and obese [5] and has recently been battling an alarming increase in the prevalence of overweight [2][4]. Overnutrition is strongly associated with several non-communicable diseases (NCDs), including coronary heart disease, stroke, type 2 diabetes, and hypertension [4].

The investigation of overweight and obesity is not new in Nigeria. Alabi and Badru [6] and Kandala and Stranges [7] have investigated regional variation in overweight among Nigerian women using the 2008 and 2018 National Demographic Health Survey (NDHS), respectively. And Okoh [8] investigated the correlation of sociodemographic variables on overweight and obesity among Nigerian women of reproductive age. However, we found no study with interest in only married women in Nigeria. Here, our concern is the impact of marriage or cohabiting on weight due to overwhelming evidence that married women are more likely to be overweight or obese compared to their non-married counterparts, in Nigeria [8][9], the rest of Africa [3][10], and other regions [11][12][13].

Many studies have focused on obesity ($\geq$30 body mass index [BMI]) [12][14][15]. However, we are focused on overnutrition, that is, weight 'above normal' ($\geq$25 BMI) due to excess intake of nutrition among married or cohabiting women [16], and to understand the influencing factors. Several factors may be responsible for excess weight gain in women, such as parity, inability to return to the pre-pregnancy physical activity level, age, level of education, wealth index, health decision making, employment status, place of residence, and region [8][12][14][15][17]. The influence of husbands or partners has gained little traction on the weight of women, but Chen et al. [18] established that there is a moderate correlation in spousal weight. To fill this gap, the husband's demographic variables such as age, level of education, and employment status were included in this study [18]. The variables present different levels of influence, such as intrapersonal and interpersonal relationships. Therefore, the variables were organized into the socioecological model (SEM) levels - intrapersonal, interpersonal, community/societal [6][19].

The SEM posits that the health and behaviour of an individual are influenced by socioenvironmental factors, beyond individual health behaviour [6]. Therefore, this study investigates the prevalence of overweight and the influence of different levels of the SEM among married Nigerian women, and we hypothesized that the Southern region will have higher burden of overnutrition compared to the Northern region.

2. Methods

2.1. Data and population

This study utilized the most recent published 2018 National Demographic and Health Survey. The survey is the latest and the sixth one conducted on the health status and demographic issues in Nigeria. The NDHS was conducted by the National Population Commission of Nigeria with support from agencies, such as World Health Organization, Global Fund, the United States Agency for International Development (USAID), United Nations Population Fund, Bill and Melinda Gates, and ICF. The nationally representative survey sample participants across the 36 states of the federation and the Federal Capital Territory (Abuja). The sampling details are available here https://dhsprogram.com/pubs/pdf/FR359/FR359.pdf

The survey comprised 41,821 women of reproductive age (15-49 years). The current study focuses on women who are either married or living with a partner - 28,888 women met this criterion. This study focused on this category because some of the interpersonal level factors (such as marriage type, partner's education, etc.) are only applicable to married women and those living with a partner. The respondents without BMI records were excluded, which reduced the number of respondents to 10,588. Five respondents whose BMI figures were "flagged" were also excluded- the flagged respondents' were outliers and their BMI was likely inaccurate. Furthermore, women who were pregnant at the time of the survey and those lactating for up to 2 months were excluded from our study [17]. The eventual number of eligible respondents analyzed in this study was 8,531.

2.2. Outcome variable

The body mass index is the dependent variable in this study. The NDHS measured the respondents' weight and height objectively and reported the BMI. BMI is universally measured as weight (kg) divided by height (m^2). Respondents with BMI <25 kg/m^2 were categorized as underweight/normal

weight and coded '0' while those with BMI ≥ 25 kg/m^2 were categorized as overweight/obese and coded '1' in accordance with previous studies [20][21].

2.3. Independent variables

The selection of variables was informed by the SEM. A total of 15 variables were identified. The independent variables were categorized into three socio-ecological levels: individual level, interpersonal level, community/societal level. At the individual level, six variables were identified namely: age, education, religion, employment status, wealth index, and health insurance. Age was reported as a ratio variable, while religion was categorized originally as 'Catholic', 'Other Christian', 'Muslim', 'Traditional', and 'Others'. Religion was re-categorized into 'Christian, 'Muslim' and 'Others'. The level of education of the respondents was captured at four levels in the data set: 'no formal education', 'primary education', 'secondary education', and 'tertiary education' as given in the survey data. The wealth index was captured as 'poorest', 'poorer', 'middle', 'richer', and 'richest'. For employment, 'yes' or 'no' was used to describe whether or not the respondents are currently working. Similarly, health insurance had binary responses 'yes' or 'no' as given in the data set.

At the interpersonal level, participants were asked during the survey, 'including yourself, in total, how many wives or live-in partners does your husband/partner have?' Those who said '1' were considered monogamous, while those who stated more than 1 were regarded as being in a polygynous marriage. Husband/partner's age, level of education, and employment status were captured the same way as the previous level. Lastly, respondents were asked who makes health decisions for them with four outcomes: 'respondent alone', 'husband/partner alone', 'joint', and 'others'. The number of living children and the total number of persons living in the house (family size) were reported as continuous variables in the data set and treated as such at the inferential level of analysis.

At the community/societal level, the type of place where participants reside was categorized into 'urban' and 'rural' while the region was categorized into the six geopolitical zones, namely, 'North Central', 'North East', 'North West', 'South East', 'South-South', and 'South West'.

2.4. Data Analysis

Descriptive analysis was presented with frequencies, percentages, median and interquartile ranges. A chart was used to show the level of overweight/obesity across the 36 states and the Federal Capital Territory, Abuja. Bivariate logistic regression was conducted to examine the association between each

independent variable and overweight/obesity. Later, hierarchical multivariate logistic regression models were computed – in line with the theoretical model – starting with the individual level (Model 1). In model 2, interpersonal level variables were added to the first model. In model 3, community/societal variables were included, that is, all variables in the study. Multicollinearity among the independent variables was checked and no evidence of such was found as Variance Inflation Factor was less than 0.3. The accuracy and predictability of the variables were checked using the area under the curve (AUC) obtained from the receiver operator characteristics curve. The accuracy was considered 'small' if AUC = 0.5 − 0.6, 'moderate' if AUC = > 0.6 − ≤0.7, and 'large' if AUC = > 0.7 − ≤ 0.8, and 'very large' when AUC > 0.8 [22][23]. Data were analyzed with the SPSS version 26 and p-value <0.05 was considered significant.

3. Results

3.1. Sociodemographic characteristics and other variables

The median age of the participants is 32.75 years. The majority belong to the Islamic faith (51.1%), while 48.1% are Christians. A significant proportion has no formal education (39.2%). Thirty-three per cent have up to secondary school education, and only 9.5% are higher degree holders. As regards the wealth index, the two extremes are the least represented. The richest comprise 18.3%, while the poorest with 19.6%. The majority (73.4%) are employed, while only 2.7% of these women are insured (Table 1).

Variables	Frequency (8531)	Percentage
Median Age (IQR)	32.75 (15–49) years	
Religion		
Islam	4357	51.1
Christianity	4102	48.1
Others	72	0.8
Education		
No education	3348	39.2
Primary	1550	18.2
Secondary	2823	33.1
Tertiary	810	9.5
Wealth Index		
Poorest	1674	19.6
Poorer	1699	19.9
Middle	1798	21.1
Richer	1800	21.1
Richest	1560	18.3
Employment		
No	2272	26.6
Yes	6259	73.4
Insurance		
No	8301	97.3
Yes	230	2.7
Marriage Type*		
Monogyny	6004	70.7
Polygyny	2483	29.3

Variables	Frequency (8531)	Percentage
Median (IQR) Age of Husband/Partner	43.01 (15–95) years	
Husband/Partner Education*		
No education	2569	30.5
Primary	1362	16.2
Secondary	3113	37.0
Tertiary	1376	16.3
Husband/Partner Employment		
No	327	3.8
Yes	8204	96.2
Health Decision		
Respondent alone	936	11.0
Joint	3145	36.9
Partner alone	4429	51.9
Others	21	0.2
Household Number		
1–5	3973	46.6
6–10	3466	40.6
>10	1092	12.8
Mean household number	6.57±3.69	
Number of children alive		
0	475	5.6
1–5	6295	73.8
>5	1761	20.6
Mean household number	3.64±2.29	
Type of place		

Variables	Frequency (8531)	Percentage
Urban	3275	38.4
Rural	5256	61.6
Region		
North Central	1540	18.1
North East	1474	17.3
North West	2020	23.7
South East	1113	13.0
South South	1002	11.7
South West	1382	16.2
Body Mass Index		
Underweight	813	9.5
Normal weight	5036	59.0
Overweight	1697	19.9
Obesity	985	11.5

Table 1. Sociodemographic characteristics and other variables of married/cohabiting women in Nigeria

Less than 8531; IQR: Interquartile range

About 71% of the women are in a monogamous marriage. Regarding the husband/partner demographics, the median age is 43 years. More than one-third (37.0%) have secondary education, while 30.5% do not have any formal education; 96.2% are employed. For most of the women, husband/partner make their health decision (51.9%), 11.0% of the women make health decisions themselves, while 36.9% jointly make health decisions. Most households (46.6%) have between 1 and 5 members (mean: 6.57; SD: 3.69), while the about 21% of these women have more than 5 children alive (mean: 3.64; SD: 2.29).

3.2. Prevalence of overweight/obesity

The prevalence of overweight/obesity among married women of reproductive age in Nigeria was 31.4%. Figure 1 shows that the top nine states with the highest prevalence of overweight/obesity are Southern states (4 in South-East and South-South, with 1 in South-West). Lagos State, the economic hub of West Africa, which has the highest population density in the country, has the highest prevalence with 61.8%, followed by Anambra (South East) with 59.0%, and Rivers (South-South) with 56.1%. Yobe State was at the base with 7.8%. The 11 states with the least BMI are situated in the northern part of the country (all the seven states in the North West except Kaduna, four states from the North East, and one from North Central).
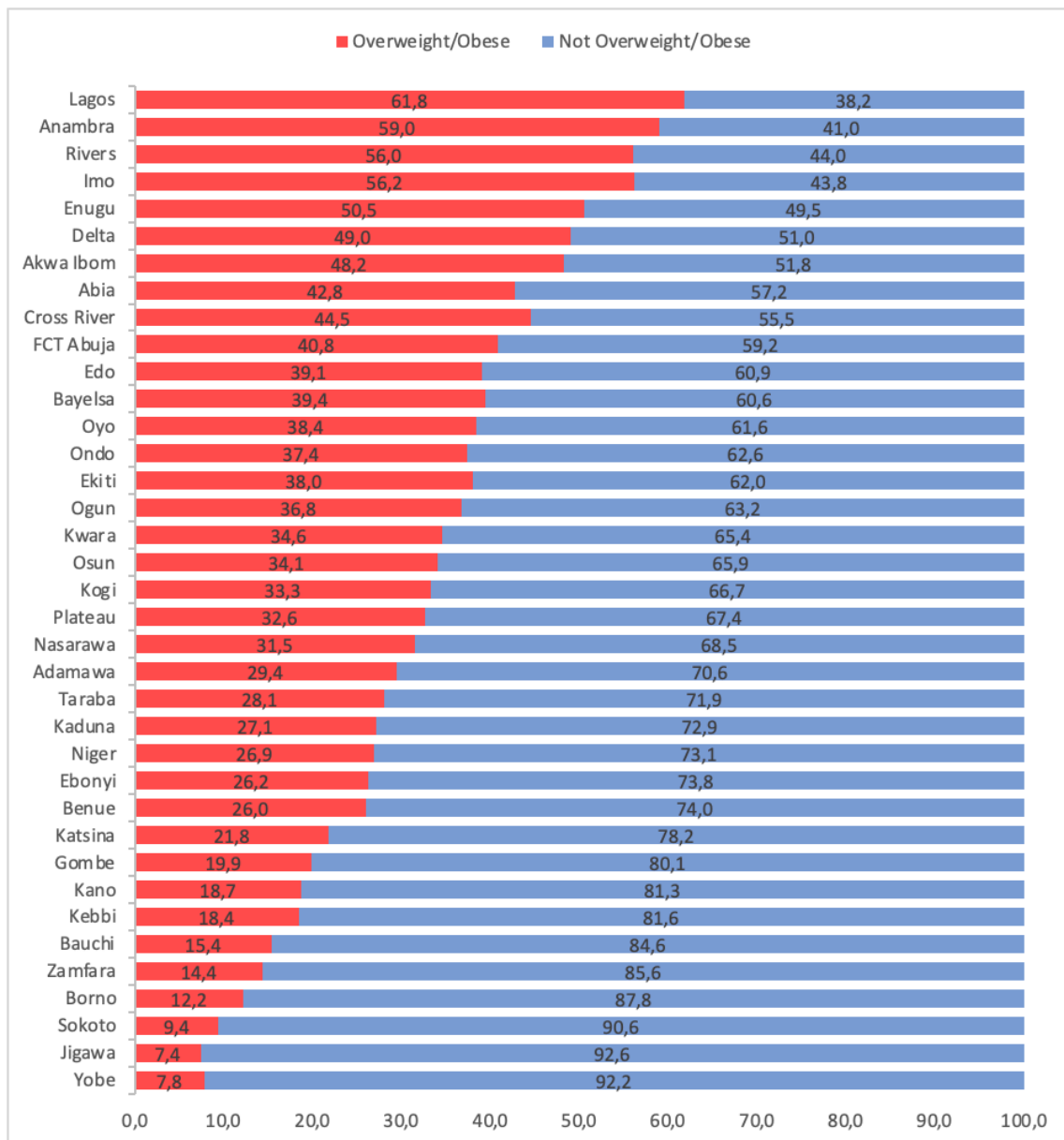
Figure 1. Prevalence of overweight/obesity among married or cohabiting women in Nigerian. The prevalence of overweight among married or cohabiting women in Nigeria varied by region. The Southern States were among the top 10 states with highest overweight burden while the least burden of overweight can be found in the Northern States.

3.3. Results from multivariate regression models

3.3.1. Model 1 (Individual level)

All the variables at the individual level were significantly associated with overweight at the bivariate level (Table 2), except employment status and insurance. Older age was a predictor of overweight (OR: 1.060; 95% CI: 1.053-1.067). Christians were 45.7% (95% CI: 1.288-1.647) more likely to be overweight/obese than Muslims. The higher the level of education completed, the higher the odds of overweight when compared to those with no formal education. Likewise, women in the wealthiest spectrum were likely to be overweight than the women in the poorest spectrum. The odds increased consistently with greater wealth – the richest women were 7.7 times (95% CI: 6.154-9.752) more likely to be overweight/obese than the poorest women. The model explained 24.9% of the variables, while Hosmer and Lemeshow test (p: 0.685) showed that the model fits. The variables provided a large predictive probability at AUC 0.763 (95% CI: 0.753-0.774; p: <0.001).

Predictors	Coefficient	p value	COR	Lower	Upper
Individual Level					
Age	0.059	**<0.001**	1.061	1.055	1.067
Religion					
Islam (Ref)					
Christianity	1.031	**<0.001**	2.803	2.547	3.085
Others	0.699	**0.005**	2.012	1.232	3.286
Education					
No education (Ref)					
Primary	0.933	**<0.001**	2.543	2.212	2.922
Secondary	1.212	**<0.001**	3.362	2.987	3.783
Tertiary	1.953	**<0.001**	7.048	5.966	8.327
Wealth Index					
Poorest (Ref)					
Poorer	0.805	**<0.001**	2.237	1.825	2.741
Middle	1.360	**<0.001**	3.898	3.215	4.725
Richer	1.934	**<0.001**	6.916	5.729	8.348
Richest	2.620	**<0.001**	13.733	11.334	16.641
Employment					
No (Ref)					
Yes	0.569	**<0.001**	1.767	1.581	1.974
Insurance					

Predictors	Coefficient	p value	COR	Lower	Upper
No (Ref)					
Yes	1.222	**<0.001**	3.394	2.597	4.437
Interpersonal Level					
Marriage Type					
Monogyny (Ref)	Ref				
Polygyny	−0.496	**<0.001**	0.609	0.548	0.677
Husband/Partner Age	0.026	**<0.001**	1.026	1.022	1.031
Husband/Partner Education					
No education (Ref)					
Primary	1.015	**<0.001**	2.758	2.357	3.228
Secondary	1.245	**<0.001**	3.474	3.047	3.959
Tertiary	1.675	**<0.001**	5.341	4.589	6.217
Husband/Partner Employment					
No (Ref)					
Yes	0.361	**0.006**	1.434	1.110	1.853
Health Decision					
Respondent alone (Ref)					
Joint	−0.074	0.362	0.928	0.801	1.077
Partner alone	−0.878	**<0.001**	0.416	0.359	0.482
Others	−2.672	**0.009**	0.069	0.009	0.517
Household Number	−0.029	**<0.001**	0.972	0.959	0.984
Number of living children	0.041	**<0.001**	1.042	1.021	1.063
Community/Societal Level					

Predictors	Coefficient	p value	COR	Lower	Upper
Type of place					
Urban (Ref)					
Rural	−0.915	**<0.001**	0.401	0.365	0.440
Region					
North Central (Ref)					
North East	−0.739	**<0.001**	0.478	0.403	0.566
North West	−0.791	**<0.001**	0.454	0.388	0.531
South East	0.627	**<0.001**	1.871	1.596	2.194
South South	0.653	**<0.001**	1.922	1.631	2.264
South West	0.447	**<0.001**	1.564	1.344	1.819

Table 2. Bivariate regression analysis between each independent variable and overnutrition among married/cohabiting women in Nigerian

Bolded p-values are significant; COR: Crude Odds Ratio

3.3.2. Model 2 (Interpersonal level)

The seven (7) variables at the interpersonal level were combined with the individual level variables and presented in model 2. All the variables that showed predictive power in model 1 remained significant in model 2. However, marriage type, household number, number of living children were not significant despite showing predictive power at the bivariate analysis. The model showed that the higher the age of the husband/partner, the higher the odds of overweight in the woman (AOR: 1.011, 95% CI: 1.003-1.019). Similar to the pattern observed in the bivariate analysis, the more educated the husband was, the higher the odds of overweight in the spouse. Women whose husbands were employed had an increased odds of overweight by 35% (95% CI: 1.000-1.825). This implies that women whose husbands/partners were unemployed are less likely to be overweight/obese. Regarding health decisions, women that take health decisions alone are more likely to be overweight/obese.

Model 2 increased the explanatory power (i.e Nagelkerke R^2) from 24.9% at the individual level to 25.4%. The variables in model 2 provided a higher predictive probability at AUC 0.766 (95% CI: 0.755-0.777; p: <0.001) compared to AUC 0.763 in model 1.

3.3.3. Model 3 (Community/Societal level)

Community level variables were added to the individual and interpersonal variables in model 3. Age remained significant across all the models with only a slight moderation to the AOR (1.060 to 1.051). Christianity was associated significantly with overweight across the three models with AOR of 1.46, 1.37, and 1.26, respectively. Primary and secondary level education were predictive in the first two models but were no longer significant at model 3. Therefore, only tertiary-educated women were significantly more likely to be overweight with an odds ratio of 1.57 (95% CI: 1.216-2.014) compared to women with no formal education. The wealth index remained highly significant with a p-value of <0.001 in all three models. In model 3, the richest women were about 6.1 times (95% CI: 4.699-7.844) more likely to be overweight/obese than the poorest women.

Also, increasing husband/partner's age and level of education remained significant predictors of overweight/obesity. Married women living with employed men were 37.6% (95% CI: 1.017-1.861) more likely to be overweight as shown in Table 3. Health decision also remained significant at model 3; women whose partner alone take health decision were less likely to be overweight (AOR: 0.83; 95% CI: 0.693-0.982) compared with women that make health care decision alone. Likewise, women whose health decisions are decided by others were less likely to be overweight compared with women that make health decisions themselves (AOR: 0.09, 95% CI: 0.012-0.716).

Socio-ecological Levels	Model 1		Model 2		Model 3	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Individual Level H&L Test (p): 5.661 (0.685) Nagelkerke R^2: 0.249 Model χ^2 (p): 1634.233 (<0.001)						
Age	1.060	**1.053-1.067**	1.051	**1.039-1.062**	1.051	**1.039-1.062**
Religion						
Islam (Ref)						
Christianity	1.457	**1.288-1.647**	1.370	**1.199-1.564**	1.255	**1.075-1.465**
Others	1.220	0.720-2.069	1.184	0.697-2.011	0.997	0.577-1.723
Education						
No education (Ref)						
Primary	1.304	**1.105-1.539**	1.190	0.999-1.418	1.154	0.965-1.380
Secondary	1.364	**1.152-1.615**	1.234	**1.028-1.481**	1.193	0.989-1.438
Tertiary	1.780	**1.424-2.225**	1.611	**1.255-2.067**	1.565	**1.216-2.014**
Wealth Index						
Poorest (Ref)						
Poorer	1.890	**1.529-2.337**	1.808	**1.458-2.241**	1.763	**1.421-2.188**
Middle	2.896	**2.350-3.569**	2.674	**2.159-3.313**	2.488	**1.999-3.096**
Richer	4.689	**3.787-5.805**	4.262	**3.418-5.314**	3.831	**3.041-4.825**
Richest	7.745	**6.152-9.752**	6.844	**5.385-8.697**	6.071	**4.699-7.844**
Employment						
No (Ref)						
Yes	0.962	0.846-1.094	0.907	0.793-1.038	0.912	0.796-1.045
Insurance						
No (Ref)						
Yes	1.280	0.947-1.731	1.248	0.921-1.692	1.240	0.913-1.684
Interpersonal Level H&L Test (p): 3.119 (0.927) Nagelkerke R^2: 0.254 Model χ^2 (p): 1670.796 (<0.001)						

Socio-ecological Levels	Model 1		Model 2		Model 3	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Marriage Type						
Monogamous (Ref)						
Polygamous			0.895	0.776-1.033	0.915	0.792-1.057
Husband/Partner Age			1.011	**1.003-1.019**	1.011	**1.003-1.018**
Husband/Partner Education						
No education (Ref)						
Primary			1.259	**1.037-1.530**	1.233	**1.013-1.500**
Secondary			1.355	**1.128-1.629**	1.330	**1.106-1.601**
Tertiary			1.345	**1.086-1.665**	1.351	**1.089-1.677**
Husband/Partner Employment						
No (Ref)						
Yes			1.350	**1.000-1.825**	1.376	**1.017-1.861**
Health Decision						
Respondent alone (Ref)						
Joint			0.874	0.740-1.032	0.886	0.749-1.047
Partner alone			0.811	**0.682-0.964**	0.825	**0.693-0.982**
Others			0.086	**0.011-0.671**	0.091	**0.012-0.716**
Household Number			1.004	0.986-1.022	1.004	0.986-1.022
Number of living children			0.998	0.966-1.030	0.998	0.966-1.030
Community/Societal Level H&L Test (p): 1.244 (0.996) Nagelkerke R^2: 0.257 Model χ^2 (p): 1690.857 (<0.001)						
Type of place						
Urban (Ref)						
Rural					0.846	**0.750-0.955**

Socio-ecological Levels	Model 1		Model 2		Model 3	
	AOR	95% CI	AOR	95% CI	AOR	95% CI
Region						
North Central (Ref)						
North East					0.875	0.719-1.065
North West					0.826	**0.683-0.999**
South East					1.015	0.834-1.234
South South					1.200	0.987-1.458
South West					0.855	0.716-1.021

Table 3. Hierarchical logistic regression analysis of socioecological levels and overnutrition among married/cohabiting women in Nigerian

Bold p-values are significant; AOR: Adjusted Odds Ratio

This study found evidence that women living in rural areas had a lesser odd of overweight compared with those in the urban setting (AOR: 0.846, 95% CI: 0.750-0.955). Although the region demonstrated predictive power at bivariate regression, some changes were observed in model 3. The variable showed in the bivariate analysis that southern women have a higher likelihood of being overweight compared to women in North Central (reference category), but in model 3, it was observed that overweight in women did not differ between Southern regions and North Central, and those in North West had a significantly lower likelihood of overweight (AOR: 0.826; 95% CI: 0.683-0.999).

The community/societal model increased the explained variance from 25.4% at the interpersonal level to 25.7% with Hosmer and Lemeshow test p-value of 0.996. The variables provided a large predictive probability at AUC 0.767 (95% CI: 0.757-0.778; p: <0.001), which is higher than the two other models.

4. Discussion

Using the 2018 NDHS, the present study assessed the prevalence and predictors of overweight/obesity among married women of reproductive age in Nigeria through the lens of the socio-ecological framework. The prevalence of overnutrition among married Nigerian women in the present study was 31.4%; this is higher than the 25.5% reported in a recent meta-analysis conducted among all women [24]. The disparity in prevalence is likely to be due to the population of interest, our study focused on only married/cohabiting women while all women irrespective of marital status were considered by Adeloye et al. [24]. Our finding, however, is similar to the 31.95% reported in a Chinese Health Survey among married women [18], 36.4% in Canada [25], and 36.6% reported from the 2015 Zimbabwe National Demographic Health Survey [4]. However, the finding is higher than the 10.3% among married women in Japan [26], and the 18% reported in Bangladesh [17]. The difference between the finding in this study and an earlier study that utilized the 2008 NDHS [7] is an indication that the prevalence of overweight/obesity has increased in Nigeria by about 10% in a decade. Such difference may be attributed to increasing urbanization and attendant consequences on sedentarism and other overweight-prone lifestyles.

4.1. Individual level

All the variables (age, religion, education, wealth, employment and insurance) at the individual level were significant at bivariate analysis. However, at the multivariate level (model 1), employment status and being insured proved protective of overweight/obesity. Employment status was also reported to be protective in Bangladesh [17], and insurance protective in China [27]. Increasing age as a predictor of overweight/obesity has been similarly reported in previous studies on overweight/obesity conducted in sub-Saharan Africa [7], Gambia [14], Ethiopia [3], Zimbabwe [19], Malawi [2], and other regions of the world including Bangladesh [28], and China [27]. There are several reasons why older women are overweight/obese compared to younger women. The first plausible reason could be that older married women are less physically active than younger women [29]. The second reason could be linked with reproduction. The median age in this present study was 32.75 years, this is perhaps the peak period of reproduction among Nigerian women. A previous finding from Bangladesh gives credence to this assumption; the age group 33 to 37 years had the highest odds (OR: 2.85 95% CI: 2.29-3.55) of overweight/obesity compared with other age groups [17]. A third possible reason relates to

metabolism. The rate of metabolism reduces with increasing age [30], which means that even when an individual's diet remains constant, the tendency of adding weight increases with age. Fourth, it could be that some women find it difficult to return to pre-pregnancy weight after childbirth due to lack of physical activity and depression [15]. A fifth possible reason is that older women are likely to be married for a longer time, particularly in Northern Nigeria, where women get married relatively earlier. A longer period of cohabiting may lead to higher parity which has been linked to gestational weight gain [14].

Regarding the level of education, higher education is linked to overweight/obesity in the present study. Highly educated women may have more economic power to live a luxurious lifestyle and escape physical labour [31][32]; both have a positive correlation with obesity. This assumption was confirmed in model 3 as the odds of overweight/obesity increased with the wealth index. This finding is consistent with earlier studies [3][12][14][17][19][33]. In the same vein, highly educated women are more likely to work in the formal sector where sedentarism is likely, while those with little or no education may find themselves in the informal sector where physical labour is more prevalent [31]. Another possible reason is the education discrepancy between women and their spouses. About 83.7% of married women in our study are married to men with secondary school education and below. Highly educated women married to less-educated men have a higher risk of overweight/obesity due to unhealthy lifestyles shared with their spouse, including secondhand smoking and poor dietary pattern [26]. Put differently, an unhealthy habit from the husband can migrate to the wife [34]. Regarding wealth, there is a common belief - especially among the less educated - that "olowo lo n yokun" (the wealthy possess abdominal fat). So, adding weight is often seen as a sign of enjoyment and good living by many. In fact, to many, the bodyweight of a newly married woman is a reflection of the extent to which her husband is taking care of her. Married women that add some weight are believed to be experiencing good care from their partners.

4.2. Interpersonal

An increase in the age of a woman's partner increases her odds of being overweight/obese. This finding further strengthens the evidence that spousal resemblance is a key factor that influences the health of an individual [18]. The change in lifestyle, environment or socioeconomic condition of couples may explain the surge in weight gain after marriage [18]. Recall that the median age of married women and their partner/husband is 32.75 and 41.01 years, respectively (Table 1). This is perhaps the

age range for exploration of food and entertainment, which may increase their weight. This observation was confirmed by an earlier previous that used the sixth National Health Survey in China [18]; the weight of married men and women above 40 years was higher than those below 40 years, with a decline during the 50s.

This study found that the higher the level of education of the husband/partner, the higher the odds of obesity in women. The odd was highest among husbands with tertiary education, but the reverse was found in an earlier study [26]. But there is a plausible reason for the current finding; educated husbands are likely to earn more compared to husbands with lesser or no form of education. More so, women whose husbands are employed are about more likely to be overweight/obese in the fully adjusted model. In an attempt to test the influence of husband employment on the women BMI, both variables were fitted in a separate regression model (result not shown). Interestingly, the husband's employment status did not influence overweight/obesity in the presence of women's employment (AOR: 1.158; 95% CI: 0.892-1.505, p: 0.271). However, the economic strength of the women played a significant role in their journey to excess body weight gain (AOR: 1.1748; 95% CI: 1.563-1.956, p: <0.001). This can translate to better financial circumstances to live a better life. The downside of better economic status is the ability to purchase and consume obesity-prone foods - often as a show of wealth - and engage in entertainment that promotes a sedentary lifestyle, both of which can increase weight over the acceptable range [31][32]. In addition, this finding supports the nutrition transition theory that states that an increase in wealth leads to a shift into an unhealthy dietary pattern [19][35].

Decisions making predict overweight in the present study. Although when couples make decisions together, it does not translate to overweight/obesity. However, when married women take health decisions alone, it significantly leads to overweight/obesity as found in this study. A plausible reason could be the sociocultural pressure to appear more robust as some culture sees fatness or plumpness as a symbol of living a good life and beauty [36], therefore, some married women may ensure an imbalance between energy intake and expenditure to facilitate high Quetelet index. Secondary data from Malawi found no association between health decision and overweight/obesity among women [2].

4.4. Community/society

In model 3, the type of place and region were included to complete the hierarchical model analysis. This study found that women in rural areas are less likely to be overweight/obese compared with women in urban areas. This finding is consistent with earlier studies in sub-Saharan Africa – 2008

NDHS Nigeria [7], Burkina Faso [37], Ethiopia [36], Gambia [5], Malawi [2], and Zimbabwe [4], and outside Africa - China [27]. Conversely, urban area lost significant power in the presence of other covariates in Zimbabwe [19] and Ghana [14]. There are a few possible reasons for this finding. One, the level of development in the urban area may not permit physical activity as most people are likely to move around with vehicles [37], also there are likely to be limited space for physical activities [12]. Two, urban areas are known for industries and commercial activities where people are either busy at work or trading. The busyness force many to feed on high-calorie food such as snacks and sugary drinks. These are likely to promote sedentary lifestyles that predispose women to overweight/obesity.

Regarding region, except Abuja – the federal capital territory (FCT), the first fifteen states with the highest overweight/obesity prevalence are in the Southern part of Nigeria. The result support our hypothesis that the Southern region will have higher burden of overnutrition compared to the Northern region. Married women in Lagos State – the commercial hub of Nigeria – have the highest prevalence of overweight/obesity (61.8%) in Nigeria, which may be due to urbanization. Furthermore, commercial activities in Lagos are almost 24 hours as business start early and close late.

In respect to the socioecological hierarchical regression to identify the level that has more influence on overnutrition among married women in Nigeria. The finding has to be interpreted with caution as the explanation of variance of each level is similar – 24.9% in model 1 (individual level), 25.4% in model 2 (interpersonal), and 25.7% in model 3 (community/societal). Even though model 3 variation is higher than the other levels after the addition of region and type of place, model 3 cannot be categorically stated to influence overweight/obesity, better than other levels, among married women in Nigeria. Further study is required, preferably a longitudinal study, to ascertain causation between overweight/obesity and the socio-ecological level that mostly predict overweight/obesity among married women in Nigeria.

5. Conclusions

The prevalence of overweight among Nigerian married women is high. Factors associated with overnutrition are at all the SEM levels. However, it makes sense to conclude that looking at the different levels of the socio-ecological model is important than treating them apart; therefore, it is better to consider all the levels when planning for public health interventions. There is a need for to-be-wedded and newly-wedded to be informed about the dangers of overnutrition by clinicians during prewedding screening, counsellor and religious leaders.

Ethical Considerations

Permission was obtained from the DHS programme office to utilize the data (https://dhsprogram.com/data/).

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Author Contributions

Oluwaseun Badru: Conceptualization, Methodology, Data Curation, Formal Analysis, Writing Original Draft, Writing – Review & Editing, Visualization. **Tunde Alabi**: Conceptualization, Methodology, Writing Original Draft, Writing – Review & Editing, Visualization.

Author Declarations

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