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Assessment of the Prevalence of Body Mass Index in Some Rural Agro-Settlements, South-East Nigeria

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Abstract
This study was focused on the assessment of the prevalence of body mass index in some rural agro-settlements, in south-east Nigeria. A community-based cross-sectional survey design was adopted. A sample size of 400 was randomly selected. Slovin's formula $n=N/(1 + N*e^2)$ was used to estimate the sample size from the population of 148,415 for Isi-Uzo local government area. The sample size of 385 was rounded up to 400 to ensure inclusiveness and representation of the towns involved. The research examined the prevalence of body mass index (BMI) among residents in the Isi-Uzo Local Government Area, focusing on gender, communities, educational status, and monthly income level. The findings revealed no significant gender-based differences in BMI among the participants, although overweight was more prevalent in males, while underweight, normal weight, and obesity were more prevalent in females. Significant differences in BMI were observed across different communities, with higher rates of underweight and normal weight in Umualor, overweight in Neke, and obesity in Mbu. Regarding educational status, normal BMI was predominant across all levels. Monthly income level also showed significant differences in BMI, with underweight more common among those with no income, normal BMI prevalent among those with a monthly income of ≤ N10,000, overweight higher in the N75,001 to N100,000 income range, and obesity more common in the N100,001 to N150,000 income range.
Keywords: Assessment, prevalence, BMI, rural agro-settlements, Isi-Uzo local government area
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Introduction

Obesity is a scourge currently raising concerns and has become an object of discussion amongst researchers. Being underweight on the other end of the spectrum of extremes of malnutrition is a condition also prevalent in low- and middle-income countries (Reyes Matos et al., 2020). Global estimates of the prevalence of underweight adults average 462 million (Tusa et al., 2020). The World Health Organization stated that worldwide obesity has tripled since 1975 (NCD-RisC, 2017; WHO, 2021). Several studies have listed the risk factors associated with obesity and the roles it plays in various disease conditions such as diabetes, cancer, hypertension, and cardiovascular diseases (Hendren et al., 2021; Okati-Aliadab et al., 2022; Sakboonyarat et al*.,* 2022). Obesity and overweight stem from an imbalance between energy intake and consumption which causes an unhealthy accumulation of fats in the body (Stos et al., 2022). Increased prevalence of obesity has been linked to factors such as eating habits, physical activity, and sociocultural and economic changes (Mokdad et al*.,* 2016; Mokdad et al*.,* 2018).

As is observed for overweight and obesity, underweight people also have increased mortality compared to people of normal weight (Tusa et al., 2020). Being underweight is associated with health conditions such as poor nutrient intake and underlying health problems including HIV/AIDS, respiratory infections, malaria, and diarrheal disease (Tusa et al., 2020).

The Body Mass Index (BMI) is a numerical indicator of an individual's body weight category defined by a ratio of the individual's mass to height (kg-2) (Okati-Aliadab et al., 2022). An individual's BMI less than $18.5kg/m^2$ is considered underweight. Overweight and obesity range from 25 - 30 kkg^2 on the BMI spectrum (Reyes Matos et al., 2020).

The NCD Risk Collaboration (2019) reported that BMI indicative of obesity and overweight is increasing at alarming rates in rural areas and this has contributed to the 55% global rise in mean BMI. This changing prevalence in BMI of rural settlers may be blamed on the dynamism of socio-economic factors.

Considering the various health issues posed by underweight, obese, and overweight, it is pertinent that on-time investigations be conducted to ascertain the nutritional status of the population. The researchers in this study aim to assess the prevalence of BMI and draw a link between certain socio-demographic parameters and body weight among subjects drawn from certain rural agro settlements in southeast Nigeria.

Materials and Methods

Study Area

The study area Isi-Uzo local government area Enugu State is an integral part of Enugu east senatorial zone covering an area of 877km^2 and has an estimated population of 148,415 according to the 2006 census. The area is positioned on the globe on the 6°43'50.38" N 7°41'34.58"E. It is bordered on the north by Udenu local government area, on the northeast by Benue state, on the east by Ebonyi state, and the south by Enugu local government area, and west by Nsukka Local Government Area. The community houses majorly farmers and traders.

Study Design

A community-based cross-sectional survey design was adopted in this study on a representative sample of 400 respondents of ages above or equal to 35 in the five towns making up Isi-Uzo namely Eha-Amufu, Neke, Umualor, Ikem, and Mbu. Data collection lasted for 2 months with several members of the research team on the field. The study involved two approaches, first a structured questionnaire survey and anthropometric measurements. The anthropometric measurements were made at the respondents' residents by qualified personnel using standard devices. The questionnaires were presented to the respondents and filled and returned immediately. Anthropometric measurements were used to ascertain the respondent's BMI and these were grouped into four categories, **Underweight** (< 18.5 kg/m^2), **Normal** (18.5 – 24.9 kg/m^2), **Overweight** (25.0 – 29.9 kg/m^2), **Obese** (30.0 – 34.9 kg/m^2).

Study Population and Sample Size

The population of the study comprised all adults in Isi-Uzo LGA. A sample size of 400 was randomly selected. The Slovin's formula n=N/ (1 + N*e^2): where n = sample size; N=population size; e=level of precision, 0.05) was used to estimate the sample size from the population of 148,415 for Isi-Uzo LGA (Kasiulevicus *et al.,* 2006). The sample size of 385 was rounded up to 400 to ensure inclusiveness and representation of the towns involved.

Statistical Analysis

The data obtained were analyzed using a statistical package for social sciences (SPSS) 20.0Chi-square analysis was used to test the association between socio-demographic parameters and BMI prevalence among respondents.

Results

The overall prevalence of body mass index among the studied residents in Isi-Uzo Local Government Area according to gender and communities are presented in Tables 15 and 16. From the result, there was no gender-based significant difference (χ^2 = 7.665, p = 0.053) in the different body mass index of the study participants (Table 1). However, it was observed that the residents had a higher prevalence of underweight (15, 33.6%), normal weight (168, 63.6%), and obese (9, 64.3%) females, with more prevalent overweight males (49, 52.1%). Table 16 shows the overall prevalence of the different communities, and recorded significant differences (χ^2 = 59.942, p < 0.0001) in the different body mass index when compared by the studied communities. It was observed that the residents of the Umualor community had more underweight (14, 50.0%) and normal weight (74, 28.0%) prevalence. The prevalence of overweight (28, 29.8%) and obese (5, 35.7%) residents were higher in Neke and Mbu respectively (Table 2).

Table 1: Overall prevalence of body mass index among the studied population in Isi-Uzo Local Government Area according to gender

Body Mass Index	Total Examined	Gender	Prevalence (%)
Underweight (< 18.5 kg/m^2)	28	Male	13 (46.4)
		Female	15 (53.6)
Normal (18.5 – 24.9 kg/m^2)	264	Male	96 (36.4)
		Female	168 (63.6)
Overweight (25.0 – 29.9 kg/m^2)	94	Male	49 (52.1)
		Female	45 (47.9)
Obese (30.0 – 34.9 kg/m^2)	14	Male	5 (35.7)
		Female	9 (64.3)
		χ^2 = 7.665, *df* = 3, *p* = 0.053	

[1]All values are expressed as frequency and percentage in parenthesis.
[2]Significant difference ($p < 0.05^*$) in prevalence using Chi-square test (χ^2).

Table 2: Overall prevalence of body mass index among the studied population in Isi-Uzo Local Government Area according to community

Body Mass Index	Total Examined	Community	Prevalence (%)
Underweight (< 18.5 kg/m^2)	28	Eha-Amufu	7 (25.0)
		Ikem	0 (0.0)
		Mbu	5 (17.9)
		Neke	2 (7.1)
		Umualor	14 (50.0)
Normal (18.5 – 24.9 kg/m^2)	264	Eha-Amufu	56 (21.2)
		Ikem	21 (8.0)
		Mbu	64 (24.2)
		Neke	49 (18.6)
		Umualor	74 (28.0)
Overweight (25.0 – 29.9 kg/m^2)	94	Eha-Amufu	8 (8.3)
		Ikem	27 (28.7)
		Mbu	20 (21.3)
		Neke	28 (29.8)
		Umualor	11 (11.7)
Obese (30.0 – 34.9 kg/m^2)	14	Eha-Amufu	3 (21.4)
		Ikem	3 (21.4)
		Mbu	5 (35.7)
		Neke	2 (14.3)
		Umualor	1 (7.1)
		$\chi^2 = 59.942$, $df = 12$, $p < 0.0001^*$	

[1]All values are expressed as frequency and percentage in parenthesis.
[2]Significant difference ($p < 0.05^*$) in prevalence using Chi-square test (χ^2).

Table 3 shows the prevalence of body mass index among the studied population in the Isi-Uzo Local Government Area according to their educational status. There were no significant differences in the body mass index of the residents ($p = 0.006$). It was observed that normal body mass index was more prevalent among the residents irrespective of their educational status of primary (97, 70.8%), secondary (55, 61.1%), and tertiary level (27, 46.6%), as well as those with no formal education (85, 73.9%).

Table 4 shows the prevalence of body mass index among the studied population in the Isi-Uzo Local Government Area according to their monthly income level. The differences in prevalence were highly significant ($p < 0.0001$). The underweight was higher among residents with no monthly income (3, 25.0%). The normal body mass index was higher among residents with a monthly income range of ≤ ₦10,000 (89, 76.1%). Overweight was higher among residents with ₦75,001 to ₦100,000 monthly incomes (14, 77.8%), while obesity (2, 66.7%) was higher among the ₦100,001 to ₦150,000 monthly income earners.

Table 3: Prevalence of body mass index among the studied population in Isi-Uzo Local Government Area according to their educational status

Educational Status	Total Examined	Body Mass Index	Prevalence (%)
None	115	Underweight	10 (8.7)
		Normal	85 (73.9)
		Overweight	17 (14.8)
		Obese	3 (2.6)
Primary Level	137	Underweight	9 (6.6)
		Normal	97 (70.8)
		Overweight	26 (19.0)
		Obese	5 (3.6)
Secondary Level	90	Underweight	6 (6.7)
		Normal	55 (61.1)
		Overweight	27 (30.0)
		Obese	2 (2.2)
Tertiary Level	58	Underweight	3 (5.2)
		Normal	27 (46.6)
		Overweight	24 (41.4)
		Obese	4 (6.9)
		$\chi^2 = 23.039$, $df = 9$, $p = 0.006^*$	

[1]All values are expressed as frequency and percentage in parenthesis.
[2]Significant difference ($p < 0.05^*$) in prevalence using Chi-square test (χ^2).

Table 4: Prevalence of body mass index among the studied population in Isi-Uzo Local Government Area according to their monthly income level

Monthly Income Level	Total Examined	Body Mass Index	Prevalence (%)
None	12	Underweight	3 (25.0)
		Normal	7 (58.0)
		Overweight	2 (16.7)
		Obese	0 (0.0)
≤ ₦10,000	117	Underweight	4 (3.4)
		Normal	89 (76.1)
		Overweight	20 (17.1)
		Obese	4 (3.4)
₦10,001 – ₦25,000	144	Underweight	16 (11.1)
		Normal	95 (66.0)
		Overweight	30 (20.8)
		Obese	3 (2.1)
₦25,001 – ₦50,000	80	Underweight	4 (5.0)
		Normal	51 (63.8)
		Overweight	22 (27.5)
		Obese	3 (3.8)
₦50,001 – ₦75,000	25	Underweight	0 (0.0)
		Normal	19 (76.0)
		Overweight	6 (24.0)
		Obese	0 (0.0)
₦75,001 – ₦100,000	18	Underweight	0 (0.0)
		Normal	2 (11.1)
		Overweight	14 (77.8)
		Obese	2 (11.1)
₦100,001 – ₦150,000	3	Underweight	0 (0.0)
		Normal	1 (33.3)
		Overweight	0 (0.0)
		Obese	2 (66.7)
> **₦150,000**	1	Underweight	1 (100.0)
		Normal	0 (0.0)
		Overweight	0 (0.0)
		Obese	0 (0.0)
		$\chi^2 = 105.035$, $df = 21$, $p < 0.0001^*$	

[1]All values are expressed as frequency and percentage in parenthesis.
[2]Significant difference ($p < 0.05^*$) in prevalence using Chi-square test (χ^2).

Discussions

The investigation into the prevalence of BMI in the study area Isi-Uzo is necessary considering the large health care cost and low life expectancy obesity poses. Before this study, there was yet to be literature focusing on the prevalence of BMI in the study area. The socio-economy of the area has continued to evolve tending towards urbanization and improved quality of life.

This study firstly posits a non-significant gender-based prevalence of BMI in the study area. It was however observed that there was more prevalence of extreme BMI (underweight and obese) amongst females and more overweight males. This is in concord with several researchers' opinions on the gender gap in obesity (Ameye & Swinnen 2019; Kim & Shin 2020). The prevalence of extreme BMI among the female gender has been explained by Tebekaw et al., 2014, to be due to biological and behavioral characteristics. More so, a greater proportion of the male respondents were either overweight or obese (33%) as against the female respondents (s23%). This establishes a different perspective on the gender gap in BMI prevalence. The opinion of other researchers still identifies that females have a greater chance of being obese globally (Ameye & Swinnen 2019; Ataey et al., 2020). However, the observation in this study may be due to increased awareness and concern shown by the females in weight loss and management as well as other socio-cultural factors.

The association between the community of the respondents and BMI prevalence was very significant in this study. Our data reveals that Ikem recorded no underweight respondents. Also observed was that over 59% of the respondents from Ikem were either overweight or obese. The umualor community recorded the most prevalence of underweight respondents and the least prevalence of obese respondents. The prevalence of overweight and obesity has been linked to urbanization and improved quality of life in developing countries (Luhar et al., 2020;

Stos et al., 2022). The community Ikem houses the headquarters of the local government area and could be envisaged as the most urbanized of the 5 communities making up the local government, explaining the reason for its high prevalence of overweight and obese respondents. Our results from Umualor the least urbanized of the communities studied, further made plausible the association between urbanization and BMI prevalence. The researchers' parameters for judging urbanization are on the lines of infrastructural rather than economic predisposition.

Concerning the educational status of respondents, no significant relationship was observed as regards the prevalence of BMI and thus contradicting earlier research by (Stos et al., 2022). An observation however is that a good proportion of overweight or obese respondents attained tertiary education (48.2%) and this reduced gradually with a reduction in educational level attained (32.2% for secondary, 22.6% for primary, and 17.4% for none). It was observed also that number of underweight respondents reduced progressively as educational status increased from none to tertiary. The non-significant relationship observed between BMI prevalence and educational status is indicative that educational status does not equate to quality of life in the subject area. The research cited (Stos et al., 2022), was carried out in a subject area with unparallel economic conditions and standards.

Also, from the study, a relationship was established between the income of respondents and the prevalence of BMI (Ogden et al., 2017, Stos et al., 2022). An appreciable majority of overweight and obese respondents earn between ₦75,000 – ₦100, 000 (88.9%). The proportion continued to reduce till for income earners of aboveN150,00. Hence the proportion of obese respondents increased linearly from non-earners to earners of N75,000 – N100,00 and dropped to earners above N150,000 (Stos et al., 2022). The most underweight respondents were nonearners. As explained by Ameye and Swinnen 2019, the relationship between income and the prevalence of overweight and obesity is not significant once a certain level of income is reached or may change from positive to negative. This can be explained by the fact that at better income, there is ease of access to better diet and recreation which aid in militating obesity.

Most research is focused on the health implications of being overweight with little attention on that of being underweight. In the present study, more females (53.6%) were underweight as compared with men (46.4%) in our study area. Umualor is the community with the highest prevalence of underweight (50.0%). Based on educational status, a high prevalence was observed among those that have no educational background and those with lower educational status. It was observed that those with no or low monthly income suffered more underweight. A view of our findings in light of the various limitations of this study is important. The data collected was cross-sectional and was limited to such without the inclusion of the modalities for the relationship between BMI prevalence and socio-economic and demographic associations. The limitation of availability of preexisting data in the study subject area hindered effective representation of what was and what is in the light of changing socio-economic situations.

Conclusion

Not much has been written on the interplay between socio-demographic factors and BMI prevalence in the study area. The sociodemographic factors studied were observed to have an association with the prevalence of BMI in the study area. BMI prevalence was observed not to be associated with gender and educational status, while the prevalence of BMI was significantly associated with the communities and income of respondents.

Recommendations

There is a need for better awareness of the health implications and risk factors associated with extreme BMI (underweight, overweight, and obesity). The relationship between socio-demographic factors and BMI is yet to be properly understood. Further studies are needed to create traceable patterns and to gain insight as to how the inter-relationship between these factors affects BMI prevalence.

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