ORIGINAL PAPER

Attitude, perception, and psychological consequences of obesity among HIV-positive adults: a facility-based cross-sectional survey in a high-prevalence district in Nigeria

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Abstract

Introduction: Recently, there has been a rise in the prevalence of obesity among people living with human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome (AIDS). Obesity remains a risk factor for other comorbid conditions. This study aimed to determine the attitude, perception, and psychological consequences of obesity in HIV-positive adults.

Material and methods: A cross-sectional study among 412 HIV-positive adults was conducted using an interview-administered questionnaire with validated scales to obtain data on attitude, perception, and psychological consequences of obesity. IBM SPSS Statistics version 22.0 was applied for data analysis. Respondents' characteristics were assessed by their anthropometric obesity status using proportions, mean, and standard deviation. Prevalence and 95% confidence intervals (95% CI) of psychological consequences of obesity were computed. Relationships between obesity and attitude, perception, and psychological consequences of obesity were assessed using bivariate analysis and logistic regression.

Results: More than two-thirds (68.4%) of the respondents were females. The participants' mean age was 47.4 (10.3) years. 80.6% (95% CI: 76.4-84.3) of the patients had a positive attitude and good perception (52.2%; 95% CI: 47.2-57.1) of obesity. At a 5% level of significance, obesity was associated with impaired quality of life (adjusted odds ratio [AOR] = 1.71; 95% CI: 1.04-2.83) and cognitive restraint (AOR = 1.63; 95% CI: 1.01-2.66).

Conclusions: The prevalence of obesity and its psychological consequences among people living with HIV in Nigeria is significantly high, while the attitudes and perceptions of obese people are sub-optimal, creating a need for health education and interventions.

HIV AIDS Rev 2026; 25, 1: ?-?
DOI: https://doi.org/10.5114/hivar/186766

Key words: attitude, obesity, perception, PLHIV, psychological disorders.

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Article history:
Received: 31.05.2023
Received in revised form: 03.04.2024
Accepted: 04.04.2024
Available online: 09.01.2026

International Journal of HIV-Related Problems
HIV & AIDS Review

Introduction

Current evidence suggests that obesity is the latest epidemic among human immunodeficiency virus (HIV)-positive individuals on antiretroviral therapy (ART) [1-4], with its prevalence ranging from 4.6% to 28.5% in sub-Saharan Africa (SSA) [5]. The attendant sequelae are also growing rapidly. Beyond its cardiovascular and other physical consequences, obesity is associated with numerous psychological repercussions, including depression, emotional and behavioral disorders, low self-esteem and motivational conditions, eating disorders, impaired body image, and low quality of life [6, 7]. These disorders have detrimental effects, which contribute significantly to the morbidity of obesity in the context of HIV. Furthermore, obesity impact individuals differentially based on sex, age, and ethnicity as well as influence health both directly and indirectly [6].

The suggested mechanisms for obesity among HIV-positive people are well-explored but inadequate, and include ART-induced dyslipidemia and chronic inflammation [8-10], while more conventional risk factors are increasing age, gender, sex, diet, physical activity, and environmental aspects [11, 12]. Other risk factors in the HIV context include hepatitis C virus status, substance use, alcohol, non-smoking, ex-smoking status, duration of follow-up, and HIV transmission risk group [11].

However, many of these factors are either non-modifiable or not easily amenable to interventions in the context of SSA, where there is difficult dietary variety and worsening of environment, leading to restriction of physical activities and proliferation of environmental toxicants [11]. It is, therefore, vital to identify factors amenable to change, which will positively impact obesity and its consequences. Potential factors are body weight perception and attitude. Obese people tend to underestimate their weight and losing excessive kilograms required to achieve a healthy weight, while they define higher ideal weights compared with the general population [1, 13]. Therefore, attitudes and perceptions may promote or mitigate obesity and its consequences. Conversely, the desire for weight control is not related to obesity [1]. Although influencing perception and attitudes is challenging, evidence from other contexts (for example, type 2 diabetes mellitus) show that even small weight reduction has a significant effect on the consequences of obesity [14]. Therefore, exploring attitudes and perceptions is significant in the quest for controlling obesity and its psychological consequences.

There is a need for comprehensive high-quality epidemiological evidence that is appropriate for understanding the direct burden and psychological repercussions of obesity, relevant for advocacy and planning. While there are Nigerian research examining socio-demographic characteristics as correlates of obesity [15, 16], no recent study holistically investigated the psychological effect of obesity in Nigeria. Although there are studies examining the psychological sequelae of obesity, scientific accuracy is often lacking, as these attempts focused on specific effects per time [17, 18] and not assessing holistic evaluations. Therefore, the current research might be the first to holistically investigate the psychological consequences of obesity among HIV-positive individuals, while assessing the effect of attitudes and perceptions of obesity in Nigeria.

In addition, there is a constant need for active surveillance of the growing epidemic of obesity among HIV individuals, especially the attending psychological consequences as well as attitudinal and perceptional factors, which are relevant for avoiding a potential unmitigated disaster. Our study aimed to provide preliminary information to bridge gaps in this area in Nigeria, and to quantitatively assess the attitude, perception, and psychological consequences of obesity as well as to explore their associations among HIV-positive adults in Ogun State, southwest Nigeria. We hypothesized that there is a statistically significant association between poor attitude and perception of obesity and the prevalent psychological consequences.

Material and methods

This was a facility-based cross-sectional study among 415 HIV-positive adults, aged 18 years and older, conducted in two major HIV treatment centers in Ogun State, Nigeria. The study was carried out between April 2022 and February 2023.

Setting

The study was conducted in the Ijebu-Ode axis of Ogun State (southwestern part of Nigeria), at the State Hospital in Ijebu Ode and the Babcock University Teaching Hospital in Ilishan. Ogun State has an estimated 100,000 people living with HIV (PLHIV), with over 20,827 of them accessing care in 27 comprehensive ART sites [19, 20]. Ijebu Ode (5%) has the highest HIV prevalence rate in the State, while HIV prevalence in Ogun State (1.6%) is higher than the national (1.4%) and southwest regional (1.2%) prevalence rates [21].

Study size

The minimum sample size required for valid estimates was computed using Cochran's formula, i.e., $n = (z^2 p (1 - P))/e^2$) for estimating proportions in a survey [22], assuming a 99% confidence interval (CI), the desired level of precision of 5%, a 25% non-response rate, and an estimated prevalence rate of 14.3%, which is the prevalence of obesity among people living with HIV in Nigeria [23]. Our minimum derived sample size was 435.

Eligibility criteria and study participants

All HIV-positive adults, aged 18 years or more, accessing routine care at ART treatment sites in the Ijebu-Ode axis of Ogun State for a minimum of six months, were eligible for

inclusion. The study excluded patients, who were too ill to respond. The research was conducted at two ART treatment sites within the study area, while the sample size was allocated to each of them through a proportionate allocation, based on the number of patients accessing care in each of the two ART sites. Trained graduate assistants recruited consenting HIV-positive adults successively during their routine clinic visits in the study period, until the required sample size was achieved.

Variables

The study had three broad outcome variables of interest. The first, attitude towards obesity, assessed the thoughts and feelings of respondents toward obese people. The second variable of interest was the perception of obesity, evaluating the meanings and interpretations of respondents attributed to experiences of obesity. The last main variable of interest was the consequences of obesity. In this case, the researchers measured the prevalence of established sequelae of obesity among participants, and assessed statistical differences between obese and non-obese respondents.

In addition, the study assessed the prevalence of anthropometric obesity and relevant participants' characteristics. Anthropometric obesity was the independent variable for obesity outcomes, while participants' characteristics were the study's covariates with potential confounding status.

Data source

For data collection, an interviewer-administered questionnaire was employed, consisting of two parts: the first part assessed participants' characteristics and the second measured study's variables. The questionnaire was administered by trained graduate assistants, experienced in interviewing stigma-prone population groups and in extracting valid data sets in private rooms.

Measurement

Attitude towards obesity

The attitudes toward obese persons scale (T-ATOP) is a 20-item questionnaire with responses ranging from −3 ("Strongly disagree") to 3 ("Strongly agree"), assessing negative and positive attitudes toward obesity. After summing individual scores, 60 is added to compute the final score. The final scores range from 0 to 120, with higher scores indicating positive attitudes toward obese people [24]. In this study, participants were dichotomized into positive and negative attitudes using 60 as the cut-off value. The instrument had an excellent reliability (Cronbach's $\alpha = 0.923$).

Perception about obesity

The beliefs about obese persons scale (T-BAOP) is an 8-item questionnaire, with responses ranging from −3 ("Strongly disagree") to 3 ("Strongly agree"), evaluating the extent of individuals' beliefs on controllability of obesity. After summing individual scores, 24 is added to compute the final score ranging from 0 to 48, with higher scores indicating stronger beliefs that obesity cannot be controlled by individuals [24]. In this study, participants we divided into good and poor perceptions, using 24 as the cut-off value. The instrument had an excellent reliability (Cronbach's $\alpha = 0.911$).

Psychological consequences

1. Quality of life: The obesity and weight loss quality of life (OWLQOL) questionnaire, a culturally sensitive measure of quality of life, is a 17-item tool to estimate individual's obesity and weight loss efforts, which it is responsive and easy to complete [25, 26]. The instrument had a good reliability (Cronbach's $\alpha = 0.889$).
2. General well-being: The general well-being schedule (GWB), an 18-item validated and extensively used scale, is used in obesity research to measure the subjective feeling of psychological well-being [27, 28]. GWB is a simple tool that avoids the interpretation challenges associated with physical symptoms of emotional distress [29]. The instrument had a good reliability (Cronbach's $\alpha = 0.845$).
3. Self-esteem: The Rosenberg self-esteem scale (RSE) is a 10-item scale for assessing self-esteem by evaluating attitude towards oneself [30, 31]. The RSE scale has excellent psychometric properties, and is extensively used across population groups, including obese people [29, 32]. The instrument had an excellent reliability (Cronbach's $\alpha = 0.917$).
4. Depression: The Beck depression inventory-II (BDI-II) is a 21-item scale that determines the intensity and behavioral manifestations of depression [33]. The scale is not biased by obesity [34], and is a widely employed as psychometrically valid self-report measure of depression [33]. The instrument had a good reliability (Cronbach's $\alpha = 0.849$).
5. Perceived self-image: The body shape questionnaire (BSQ), a 34-item self-report scale, assesses the weight and body shape concerns by evaluating distress with and frequency of pre-occupation with body shape and size [32, 35]. The BSQ is easy to use, showing good psychometric properties [32, 35]. The instrument had a good reliability (Cronbach's $\alpha = 0.891$).
6. Hunger and food restraint: The three-factor eating questionnaire (TFEQ) is used for predicting weight loss and monitoring treatment progress. TFEQ has good psychometric properties, and is widely applied among obese people [36, 37]. The TFEQ-18 measures cognitive restraint, uncontrolled eating, and emotional eating in obese populations [38, 39]. In this study, each domain was dichotomized into lower and greater, using the mean domain score as the cut-off value. The instrument had a good reliability (Cronbach's $\alpha = 0.879$).

7. Sleep disturbance: The Epworth sleepiness scale (ESS), an eight-item measure of daytime sleepiness [40], is a simple, psychometrically-valid, and widely used tool among obese individuals who retrospectively report dozing behavior [41, 42]. High ESS scores are significantly correlated with obstructive sleep apnea [43]. The instrument had an excellent reliability (Cronbach's $\alpha = 0.931$).

Participants' characteristics

Anthropometric obesity: It was assessed with the body mass index by dividing the weight (in kilograms) by the square of the height (in meters). Participants were then classified as obese or non-obese according to the WHO recommendations [44]. Trained research assistants conducted anthropometric measurements using standard methods, with zero-error correction and daily calibrated equipment. They measured the height to the nearest 0.1 cm while participants were standing erect against a stadiometer without head or footwear, hair ornament, or unbraided hair. The research assistants used a sensitive digital body weight scale to measure weight to the nearest 10 g. Participants were wearing only light clothing during weight measurement.

Socio-demographic characteristics: The study assessed age, ethnicity, religion, educational level, employment, and marital status.

Statistical methods

For data analysis, IBM SPSS Statistics version 22.0 was applied. First, the study derived the proportions and means (and standard deviation) of respondents' characteristics by their anthropometric obesity status. Next, the prevalence and 95% confidence intervals of psychological consequences of obesity was calculated. We used bivariate analysis (χ^2 test) to assess the relationship between obesity and attitude, perception, and psychological consequences of obesity. Finally, the study conducted four logistic regression analyses to evaluate the relationship between psychological consequences (outcome variables) and obesity (independent variable). Regression analysis for psychological consequences, which showed a statistically significant relationship with obesity on bivariate analysis at a level of significance of 0.3, was performed. In the regression analysis, we controlled for the attitude and perception of obesity and relevant participants' socio-demographic characteristics. The level of statistical significance was set at 5%.

Results

Respondents' characteristics

From the 435 consenting participants recruited and interviewed, 412 questionnaires were returned with high-quality data, providing a response rate of 94.7%. More than two-thirds (68.4%) of the respondents were females, while 58.7% were married at the time of data collection. The participants' mean age was 47.4 years, with a standard deviation of 10.3 years. About half (48.8%) of the patients had completed secondary education, while 30.8% declared primary level. Table 1 shows the prevalence rate of anthropometric obesity of 23.8% (95% CI: 19.8-28.2). A higher proportion of females (27.7%) compared with males (15.4%) were obese ($p = 0.007$), while other participants' socio-demographic characteristics (age, education, employment, marital status, ethnicity, and religion) were not statistically significantly associated with obesity ($p > 0.05$).

Obesity-related attitude, perception, and psychological disorders

Table 2 presents the prevalence of obesity-related attitudes, perceptions, and psychological disorders. Most (80.6%; 95% CI: 76.4-84.3) of the study's participants scored more than 60 on the attitudes toward obese persons scale and were, therefore, classified as having a positive attitude towards obese individuals. Conversely, about half (52.2%; 95% CI: 47.2-57.1) of the respondents scored more than 24 on the beliefs about obese persons scale and were, thus, classified as having a good perception of obese individuals.

By using the scales itemized in the methods section, it was shown that 42% (95% CI: 37.2-46.9) of the participants had impaired obesity-related quality of life. Only 21.6% (95% CI: 17.7-25.9) of them presented a positive well-being, while the others had either moderately (21.6%; 95% CI: 17.7-25.9) or severely distressed (56.8%; 95% CI: 51.9-61.6) well-being. The prevalence of low self-esteem (3.4%; 95% CI: 1.9-5.6), depression (2.9%; 95% CI: 1.5-5.0), and concern with body shape (1.7%), were low in the study population. The investigation of three domains of hunger and food restraint demonstrated that 44.9% (95% CI: 40.0-49.8) of the study cohort presented a lower cognitive restraint, 39.8% (95% CI: 35.0-44.7) reported a greater uncontrolled eating, while 26.2% (95% CI: 22.0-30.7%) showed a greater emotional eating. More than half (55.1%) of the respondents experienced mild, moderate, or severe sleep disturbance.

Relationship between obesity and obesity-related attitude, perception, and psychological disorders

Table 3 reports the findings of bivariate analyses of the relationships between obesity and obesity-related attitude, perception, and psychological disorders. The χ^2 test was used to assess the relationship between categorical variables at a level of significance of 5%. It was found that obesity was associated with only impairment of quality of life ($\chi^2 = 5.33$; $p = 0.021$) and reduced cognitive restraint ($\chi^2 = 5.33$; $p = 0.021$).

Table 1. Respondents' characteristics

Participants' characteristics	Overall	Obese	Non-obese	χ^2 (*p*-value)
Obesity, *n* (%)				
No	314 (76.2)			
Yes	98 (23.8)			
Age* (years)	47.4 (10.3)	46.8 (9.4)	47.6 (10.6)	0.63 (0.531)
Sex, *n* (%)				
Female	282 (68.4)	76 (27.7)	204 (72.3)	7.40 (0.007)
Male	130 (31.6)	20 (15.4)	110 (76.2)	
Educational level, *n* (%)				
None completed	22 (5.3)	2 (9.1)	20 (90.9)	3.94 (0.267)
Completed primary	127 (30.8)	27 (21.3)	100 (78.7)	
Completed secondary	201 (48.8)	53 (26.4)	148 (73.6)	
Completed tertiary	62 (15.0)	16 (25.8)	46 (74.2)	
Employment, *n* (%)				
Unemployed	126 (30.6)	28 (22.2)	98 (77.8)	0.25 (0.621)
Employed	286 (69.4)	70 (24.5)	216 (75.5)	
Marital status, *n* (%)				
Single, never married	15 (3.6)	3 (20.0)	12 (80.0)	1.53 (0.676)
Currently married	242 (58.7)	60 (24.8)	182 (75.2)	
Separated/divorced	79 (19.2)	15 (19.0)	64 (81.0)	
Widowed	76 (18.4)	20 (26.3)	56 (73.7)	
Ethnicity, *n* (%)				
Yoruba	341 (82.8)	85 (24.9)	256 (75.1)	2.55 (0.467)
Hausa	14 (3.4)	2 (14.3)	12 (85.7)	
Igbo	39 (9.5)	9 (23.1)	30 (76.9)	
Others	18 (4.4)	2 (11.1)	16 (88.9)	
Religion, *n* (%)				
Christianity	280 (68.0)	60 (21.4)	220 (78.6)	3.19 (0.203)
Islam	126 (30.6)	37 (29.4)	89 (70.6)	
Traditional	6 (1.5)	1 (16.7)	5 (83.3)	

**Quantitative variable t-test.*

Relationship between obesity and obesity-related psychological disorders

Table 4 demonstrates the findings of logistic regression analyses evaluating the relationship between obesity and obesity-related psychological disorders. Psychological disorders with a statistically significant relationship with obesity on bivariate analyses at a level of significance of 30% were only considered. Therefore, the relationship of obesity with quality of life, general well-being, cognitive restraint, and sleep disturbance was examined. We controlled for attitudes and perceptions toward obese persons and the participants' socio-demographic characteristics. At the 5% level of significance, obesity was associated with impaired quality of life (adjusted odds ratio [AOR] = 1.71; 95% CI = 1.04-2.83) and cognitive restraint (AOR = 1.63; 95% CI = 1.01-2.66).

Discussion

This cross-sectional study investigating obesity in Ogun State, Nigeria, reveals the burden of obesity and obesity-related psychologic disorders among PLHIV. The study demonstrates sub-optimal attitudes and perceptions of obese people in a low-resource setting. Obesity (BMI > 30 kg/m^2) was prevalent (23.8%), with women (27.7%) being more affected than men (15.4%). About half of the participants demonstrated poor perceptions, while only 19.4% had negative attitudes toward obese people. While obesity-related psychological disorders, such as distress in well-being (78.4%), sleep disturbance (55.1%), reduced cognitive restraint (44.9%), impaired quality of life (42.0%), uncontrolled eating (39.8%), and emotional eating (26.2%), were common, other factors, such as low self-esteem (3.4%), depression (2.9%), and concern with body shape (1.7%), were not common. Moreover, a statistically significant relationship

Table 2. Obesity-related attitude, perception, and psychological disorders

Study variables	Prevalence	95% CI	99% CI
Psychological consequences			
Impairment in quality of life			
No	58.0	53.1-62.8	51.6-64.3
Yes	42.0	37.2-46.9	35.7-48.4
General well-being			
Positive well-being (73-110)	21.6	17.7-25.9	16.6-27.3
Moderate distress (61-72)	21.6	17.7-25.9	16.6-27.3
Severe distress (0-60)	56.8	51.9-61.6	50.3-63.1
Self-esteem			
Low (< 15)	3.4	1.9-5.6	1.5-6.4
Normal (15-25)	64.3	59.5-69.0	58.0-70.3
High (> 15)	32.3	27.8-37.0	26.5-38.5
Depression			
No (0-17)	97.1	95.0-98.5	94.2-98.8
Yes (> 17)	2.9	1.5-5.0	1.2-5.8
Perceived self-image			
No concern with body shape (< 80)	98.3	96.5-99.3	95.9-99.5
Mild concern with body shape (80-110)	1.5	0.5-3.1	0.4-3.8
Moderate concern with body shape (111-140)	0.2	0.0-1.3	0.0-1.8
Hunger and food restraint			
Cognitive restraint			
Lower (< 27.6)	44.9	40.0-49.8	38.6-51.4
Greater (≥ 27.6)	55.1	50.2-60.0	48.6-61.4
Uncontrolled eating			
Lower (< 20.9)	60.2	55.3-65.0	53.8-66.4
Greater (≥ 20.9)	39.8	35.0-44.7	33.6-46.2
Emotional eating			
Lower (< 12.5)	73.8	69.3-78.0	67.8-79.2
Greater (≥ 12.5)	26.2	22.0-30.7	20.8-32.2
Sleep disturbance			
No sleep disturbance	44.9	40.0-49.8	38.6-51.4
Mild sleep disturbance	23.1	19.1-27.4	17.9-28.8
Moderate sleep disturbance	21.4	17.5-25.6	16.4-27.0
Severe sleep disturbance	10.7	7.9-14.1	7.1-15.2
Attitude towards obese persons			
Negative attitude (0-60)	19.4	15.7-23.6	14.7-24.9
Positive attitude (61-120)	80.6	76.4-84.3	75.1-85.3
Perception about obese persons			
Poor perception (0-24)	47.8	42.9-52.8	41.4-54.3
Good perception (25-48)	52.2	47.2-57.1	45.7-58.6

Table 3. Relationship between obesity and obesity-related attitude, perception, and psychological disorders (bivariate analyses)

Study variables	Non-obese (%)	Obese (%)	χ^2 (*p*-value)
Psychological consequences			
Impairment in quality of life			
No	192 (61.1)	47 (48.0)	5.33 (0.021)
Yes	122 (38.9)	51 (52.0)	
General well-being			
Positive well-being (73-110)	67 (21.3)	22 (22.4)	5.61 (0.060)
Moderate distress (61-72)	60 (19.1)	29 (29.6)	
Severe distress (0-60)	187 (596)	47 (48.0)	
Self-esteem			
Low (< 15)	10 (3.2)	4 (4.1)	1.40 (0.498)
Normal (15-25)	198 (63.1)	67 (68.4)	
High (> 15)	106 (33.8)	27 (27.6)	
Depression			
No (0-17)	304 (96.8)	96 (98.0)	0.35 (0.557)
Yes (> 17)	10 (3.2)	2 (2.0)	
Perceived self-image			
No concern with body shape (< 80)	309 (98.4)	96 (98.0)	0.62 (0.735)
Mild concern with body shape (80-110)	4 (1.3)	2 (2.0)	
Moderate concern with body shape (111-140)	1 (0.3)	0 (0.0)	
Hunger and food restraint			
Cognitive restraint			
Lower (< 27.6)	150 (47.8)	35 (35.7)	4.39 (0.036)
Greater (≥ 27.6)	164 (52.2)	63 (64.2)	
Uncontrolled eating			
Lower (< 20.9)	193 (61.5)	55 (56.1)	0.89 (0.345)
Greater (≥ 20.9)	121 (38.5)	43 (43.9)	
Emotional eating			
Lower (< 12.5)	234 (74.5)	70 (71.4)	0.37 (0.543)
Greater (≥ 12.5)	80 (25.5)	28 (28.6)	
Sleep disturbance			
No sleep disturbance	144 (45.9)	41 (41.8)	4.10 (0.251)
Mild sleep disturbance	77 (24.5)	18 (18.4)	
Moderate sleep disturbance	63 (20.1)	25 (25.5)	
Severe sleep disturbance	30 (9.6)	14 (14.3)	
Attitude towards obese persons			
Negative attitude (0-50)	62 (19.7)	18 (18.4)	0.09 (0.763)
Positive attitude (61-120)	252 (80.3)	80 (81.6)	
Perception about obese persons			
Poor perception (0-24)	147 (46.8)	50 (51.0)	0.53 (0.467)
Good perception (25-48)	167 (53.2)	48 (49.0)	

Table 4. Relationship between obesity and obesity-related psychological disorders (logistic regression analyses)

Independent variables	Adjusted odds ratio (95% CI)			
	QoL	GWB	CR	SD
Obesity				
No	Ref.	Ref.	Ref.	Ref.
Yes	1.71 (1.04-2.83)*	0.68 (0.42-1.10)	1.63 (1.01-2.66)*	1.10 (0.65-1.76)
Attitude towards obese persons				
Negative attitude (0-60)	0.71 (0.40-1.25)	0.60 (0.35-1.04)	2.01 (1.13-3.56)*	1.20 (0.70-2.05)
Positive attitude (61-120)	Ref.	Ref.	Ref.	Ref.
Perception about obese persons				
Poor perception (0-24)	2.26 (1.43-3.57)*	1.32 (0.84-2.06)	2.06 (1.32-3.20)*	0.82 (0.53-1.26)
Good perception (25-48)	Ref.	Ref.	Ref.	Ref.
Sex				
Female	1.35 (0.81-2.24)	0.44 (0.26-0.72)**	1.68 (1.03-2.75)*	1.40 (0.87-2.24)
Male	Ref.	Ref.	Ref.	Ref.
Age	0.99 (0.96-1.01)	1.00 (0.98-1.02)	0.99 (0.97-1.0)	1.00 (0.98-1.03)
Educational attainment				
None completed	Ref.	Ref.	Ref.	Ref.
Completed primary	0.42 (0.15-1.18)	2.34 (0.86-6.38)	1.68 (0.61-4.63)	1.40 (0.53-3.72)
Completed secondary	0.34 (0.12-0.96)*	1.64 (0.60-4.44)	1.55 (0.56-4.27)	2.10 (0.79-5.56)
Completed tertiary	0.30 (0.10-0.95)*	1.35 (0.45-4.05)	1.46 (0.48-4.46)	2.06 (0.71-6.04)
Employment				
Unemployed	2.75 (1.64-4.60)**	0.80 (0.50-1.28)	0.93 (0.58-1.48)	0.88 (0.56-1.39)
Employed	Ref.	Ref.	Ref.	Ref.
Marital status				
Single, never married	0.17 (0.04-0.69)*	1.32 (0.41-4.20)	1.01 (0.29-3.53)	0.87 (0.27-2.74)
Currently married	0.13 (0.03-0.59)*	1.23 (0.36-4.26)	0.93 (0.25-3.51)	0.83 (0.24-2.84)
Separated/divorced	0.22 (0.05-1.01)	1.30 (0.35-4.76)	1.04 (0.26-4.14)	1.12 (0.31-4.06)
Widowed	Ref.	Ref.	Ref.	Ref.
Ethnicity				
Yoruba	Ref.	Ref.	Ref.	Ref.
Hausa	1.84 (0.56-6.034)	0.34 (0.10-1.12)	0.66 (0.20-2.18)	1.54 (0.48-4.91)
Igbo	0.69 (0.31-1.52)	0.48 (0.23-1.01)	1.72 (0.80-3.69)	1.47 (0.71-3.03)
Others	2.03 (0.68-6.04)	0.87 (0.30-2.59)	2.29 (0.77-6.77)	1,76 (0.62-4.99)
Religion				
Christianity	Ref.	Ref.	Ref.	Ref.
Islam	1.27 (0.78-2.05)	0.62 (0.39-0.98)	1.15 (0.73-1.83)	1.05 (0.67-1.65)
Traditional	0.49 (0.07-3.69)	0.50 (0.08-3.00)	3.04 (0.50-18.59)	0.60 (0.10-3.55)

*$p < 0.05$; **$p < 0.01$

QoL – quality of life, GWB – general well-being, CR – cognitive restraint, SD – sleep disturbance

between obesity and impaired quality of life (AOR = 1.71) and cognitive restraint (AOR = 1.63) was found.

There are some limitations to be acknowledged in the interpretations of our findings. First, the study design was cross-sectional and as such, causal linkages should not be drawn between the study variables. Furthermore, apart from obesity, all the other study variables were based on self-report, thus the estimates are prone to bias from recall and social desirability. Negative attitudes and poor perceptions of obese individuals were likely underestimated because of social desirability. For the same reason, the prevalence of psychological disorders might have been underestimated.

Our estimate of obesity prevalence rate among PLHIV is similar to findings from other parts of Nigeria [45, 46] and high-income settings [47, 48], but is higher than the pooled prevalence in the general Nigerian population [23]. While there is a global increase in cardiovascular risk factors, such as obesity, the obesity-HIV co-existent features confers accentuated risk for cardiometabolic disorders, including hypertension, metabolic syndrome, type 2 diabetes mellitus, hypercholesterolemia, coronary heart disease, stroke, and cancers [46, 49]. Cardiometabolic disorders contribute to poor health outcomes in low-income settings. Governments, policy-makers, programmers managers, and other stakeholders, must prioritize obesity among PLHIV, especially women. The focus on women is because most studies, including the current one, agree that obesity is more prevalent among female PLHIV than men [23, 45, 46, 50]. Women tend to conserve more body fat relative to men due to the fewer daily calorie requirement per kilogram of body weight. Likewise, female and pregnancy hormones promote weight gain among women [1, 51]. There is a critical need for PLHIV-specific health awareness, promotion, and education interventions, to be mixed with regulatory and environmental strategies mitigating obesity and its cardiovascular consequences in low-resource settings, such as Nigeria.

There is a significant increase in the prevalence and overlap in the manifestation of psychological disorders in obesity and HIV. In obese people, the prevalence of depression, emotional and behavioral disorders, low self-esteem, motivational challenges, eating disorders, impaired body image, and low quality of life, have all been reported [6, 7]. PLHIV are shown to be at increased risk of psychological dysfunctions, such as substance-use disorders, depression and anxiety, post-traumatic stress disorder (PTSD), suicidal behaviors, cognitive and personality disorders, and psychosis [52, 53]. It is, therefore, plausible that we found that a huge burden of psychological disorders exists in the context of significant obesity among PLHIV. This finding is particularly relevant for low-resource settings, where poverty, lack of access to healthcare, targeted interventions, and other socio-cultural factors promoting mental disorders, are widespread. There is a need for further high-quality evidence, particularly from prospective and controlled studies, to accurately estimate the burden of psychological disorders due to obesity-HIV co-existence, especially in Nigeria and other low-resource settings. Nevertheless, setting-specific and culturally acceptable psychological interventions targeting PLHIV are required. Such interventions should consider the population-specific psychologic disorders and the needs of women. It may be essential to incorporate the interventions into the HIV care as early as possible, but the strategies should focus on enhancing PLHIV's self-esteem, general well-being, and quality of life.

More than half and about one-fifth of our study participants were assessed as having poor perceptions and negative attitudes toward obese people, respectively. Although negative attitudes and poor perceptions of obesity among PLHIV have been reported in Nepal [54], more studies exploring this subject are required in low-resource countries. In low-resource settings, it is difficult to mitigate some of the well-known risk factors of obesity, including diet, physical activity, and environment [11]. Therefore, amenable risk factors, such as perception and attitude towards obesity, which have been found to have a significant impact [1, 13, 14], are critical to the successful mitigation of obesity and its psychological consequences. In addition to gathering further attitude and perception data, researchers need to design and implement setting and content-specific interventions, to improve the beliefs and disposition of PLHIV toward obesity and obese persons.

Conclusions

The prevalence of obesity and its psychological consequences among PLHIV in Nigeria is significantly high, while the attitudes and perceptions of obese people are sub-optimal. Although continued research is essential to generate further evidence, there is a critical need for the government, policy-makers, programme managers, and other stakeholders to design and implement the context, content-specific, and culturally acceptable health education as well as psychological interventions, which will improve the attitude and perception of obesity and mitigate mental disorders among PLHIV as soon as possible after HIV diagnosis. Such interventions must focus particularly on women, and improve PLHIV's self-esteem, general well-being, and quality of life.

Disclosures

1. Institutional review board statement: The study obtained ethics approval from the Babcock University Health Research and Ethics Committee (approval number: BUHREC/647/22). All the respondents provided written consent after obtaining comprehensive information on the aims and processes of the study by trained graduate assistants. Participation in the research was fully voluntary, and the respondents could refuse or withdraw participation at any stage of the study without any consequences. The investigators ensured confidentiality by de-identifying study data. The respondents were not provided with any inducement for participation, but they received group obesity counselling after data collection.
2. Assistance with the article: None.
3. Financial support and sponsorship: None.
4. Conflicts of interest: None.

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