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Body Mass Index and its Influence on HIV Positive Patients: A Case Study of Aminu Kano Teaching Hospital

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Abstract: *A crossectional study on the influence of HIV on the body mass index of HIV patients admitted in Aminu Kano Teaching Hospital, Kano State, with the objectives of (i) evaluating the relation between height and weight of HIV-positive patients, (ii) testing the impact of gender on the BMI of HIV-positive patients, (iii) verification of the relationship between BMI and age of HIV positive patients (iv) verification of the statistical relationship between BMI of males and females HIV positive patients and (v) the prediction of best-suited model for the explanation of the height value when the BMI and weight are known. The results obtained indicated that there is a statistically significant linear relation between the height and weight of HIV-positive patients. However, the Body Mass Index does not depend on gender, and there was no observable significant difference between the BMI of male and female patients. On the contrary, the dependence of BMI on the age of the HIV-positive patients was upheld*. The study recommended periodic evaluation of the investigated and other factors among HIV patients.

Keywords: *Height, Weight, Relation, Body Mass Index, BMI*

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1.0 Introduction

HIV (Human Immunodeficiency Virus) is a virus that attacks cells, responsible for the sustenance of the human immune system. Several studies have been conducted within the entire global system concerning HIV management (Naidoo *et al*., 2018). Several development routes have been identified as sources of HIV, including the sharing of injection needles, surgical blades, unprotected sex with infected patients, etc (Justiz Vaillant *et al*., 2023). The spread of the virus is continuously increasing despite the huge knowledge concerning its prevention. Gangcuangco and Eustaquio (2023) conducted some studies in the Philippines concerning reported cases of HIV between 2012 and 2023 and observed an astronomical increase rating of 411%. Based on these findings, they concluded that HIV management in the Philippines needs multidimensional approaches, especially on sustainable political commitment and collaboration among stakeholders in the sector. India has also been documented as one of the

countries with significant incidences of HIV/AIDS and is described long-term trend by Shri *et* al. (2023). They also acknowledged the need for excessive commitment toward its management. Jain *et* al. (2023), however, identified insomnia, depression and anxiety as one of the major worries of people living with HIV in India and recommended severe intervention policies from the government. The consideration of investments in the management of HIV, in the United States of America has given more commitment than any other developed or developing country. However, cases of HIV are not significantly eradicated (Hamilton *et al*., 2023; Peterhoff, 2023), but efforts towards reduction of incidences are on top ranking considering the global community. (Chakhtoura and Kalogiannis, 2023; Lampe *et al*., 2023). Based on the documented article published by Bassey and Miteu (2023), Nigeria has the highest number of HIV cases among the Sub-Saharan African countries. Ozim *et al*. (2023) also observed that Nigeria accounts for 10% of the global cases of HIV. A critical examination of the growing trend of HIV in Nigeria was examined by Okoroiwu *et al*. (2022) and was described as a pandemic at its present status. A similar view was established by Ukaegbu *et al*. (2022) based on records reported for a period earlier than Okoroiwu *et al*. (2023). This implies that Nigeria has been in HIV pandemic over a long period.

Statistical tools are pivotal in establishing HIV incidence in Nigeria. In their description. Several studies have shown that the body mass index can be a good indicator of the health status of a body, especially within the borderlines of being overweight or tending to lose weight Ken-Opurum *et al.* (2023) conducted a study, aimed to evaluate and describe the association between HRQoL and BMI among PLWH in the US. Data were obtained from the 2018 and 2019 US National Health and Wellness Survey, an online, self-reported, general population survey. Analyses included 575 PLWH who self-reported a physician diagnosis and prescription use for the treatment of HIV, as well as 1725 propensity scores, matched non-HIV controls. After adjusting for age, sex, race, and comorbidities, higher BMI was associated with poorer physical (β = -0.18, p = 0.005) and general (β = -0.42, p = 0.014) HRQoL among PLWH. Additionally, PLWH reported poorer mental, physical, and general HRQoL than non-HIV controls; these relationships were not moderated by BMI. The potential negative impact of higher BMI on patients' humanistic outcomes should be considered in HIV management, including selection of treatment. Also, Belfrage et al. (2023) found that adolescent girls gained weight to a greater extent than expected but independently of ART. Moreover, no association between dolutegravir alone or combined with tenofovir alafenamide fumarate (TAF) and excessive weight gain. Height development was within normal range. Kaluba *et al*. (2023) confirm that Underweight pulse wave velocity(PWH) in SSA had lower augmentation index(AIX) measurements compared to normal-weight individuals, indicating less arterial stiffness. However, similar Carotid-femoral(cfPWV), crPWV andCarotid-radial(crAIX) values among the underweight and overweight PWH suggest a low BMI may not confer substantial protection against impaired vascular compliance as a contributor to CVD risk among individuals on ART. Hence, the examination of the body mass index (BMI) of HIV patients who are officially registered in the Aminu Kano Teaching Hospital is statistically examined in this work.

1.1 Aim and Objectives

The study aims to use non-parametric and parametric approaches to analyze the BMI and its influence on HIV-positive patients.

Sequels to the aforementioned aim, the following are the specific objectives of the study:

i. To determine if there is a significant relation between height and weight of HIV-positive patients.
ii. To test whether or not gender has an impact on the BMI of HIV-positive patients.
iii. To verify the relation between BMI and age of HIV-positive patients.

iv. To determine whether or not there is a statistically significant difference in BMI of males and females HIV positive patients.
v. To come up with a model that predicts the height value when the BMI and weight are known.

1.2 Research hypotheses

The formulation of an appropriate hypothesis goes hand in hand with the selection of a research problem. Hypothesis serves as an assumed answer to principal research questions of HIV-positive patients. They Are guides for the investigator in the entire process of research endeavour and they keep on the main line of his/her study. The following are statistical hypotheses for the study, and they shall be tested and confirmed or rejected in the subsequent section;

$H_{01:}$ There is no significant relation between the weight and height of HIV-positive patients.

$H_{02:}$ Gender has no significant impact on the BMI of HIV-positive patients.

$H_{03:}$ There is no significant relation between BMI and age of HIV-positive patients.

$H_{04:}$ There is no significant difference in the BMI between male and female patients.

2.0 Materials and Methods

The total group of HIV-positive patients attending Aminu Kano Teaching Hospital is used as the target population because it possesses the average characteristics to represent the research population. The study is carried out on 104 HIV-positive patients of Aminu Kano Teaching Hospital, through which statistical inferences for the whole population are to be made.

2.1 Sampling techniques

Even though it's very difficult to achieve (time, effort, and money), Simple random sampling is used in this research because the sample taken using simple random should represent the target population and eliminate sampling biases.

For this research, a secondary method of data collection is being employed, whereby the HIV-positive patient data, from Professor S.S. WALI Virology Centre at Electronic Medical Record Office are being collected.

2.2 Research design

For the problem to be efficiently examined, a cross-sectional study is being applied in this study, as it takes a snapshot of a population at a certain time and allows conclusions about phenomena across a wide population to be drawn.

3.0 Results and Discussion

The tables below represent the analyses of the data collected using SPSS:

Table 1: Correlations between Height and Weight

	Height	**Weight**
Height Pearson correlation	1	0.495
Sig. (2-tailed)		0.000
N	101	101
Weight Pearson Correlation	0.495	1
Sig. (2-tailed)	0.000	
N	101	101

Conclusion: Having r = 0.495, it shows that there exists a moderate linear relationship between the two variables (Height and Weight). Hence, we reject the null hypothesis since p-value=0.000< level of significance = 0.01 and we conclude that a correlation coefficient exists.

Table 2: Gender and BMI Category Cross tabulation

			BMI category		
			Underweight	**Normal weight**	**Overweight**
GENDER	Male	Count	7	16	10
		Expected Count	6.2	14.3	10.2
		% within GENDER	18.4%	42.1%	26.3%
		% within BMIcategory	41a.2%	41.0%	35.7%
		% of Total	6.7%	15.4%	9.6%
	Female	Count	10	23	18
		Expected Count	10.8	24.8	17.8
		% within GENDER	15.2%	34.8%	27.3%
		% within BMIcategory	58.8%	59.0%	64.3%
		% of Total	9.6%	22.1%	17.3%
Total		Count	17	39	28
		Expected Count	17.0	39.0	28.0
		% within Gender	16.3%	37.5%	26.9%
		% within BMIcategory	100.0%	100.0%	100.0%
		% of Total	16.3%	37.5%	26.9%

Table 2: Continuation Gender * BMI category Cross tabulation

			BMI Category	
			Obesity	Total
GENDER	Male	Count	5	38
		Expected Count	7.3	38.0
		% within GENDER	13.2%	100.0%
		% within BMI category	25.0%	36.5%
		% of Total	4.8%	36.5%
	Female	Count	15	66
		Expected Count	12.7	66.0
		% within GENDER	22.7%	100.0%
		% within BMI Category	75.0%	63.5%
		% of Total	14.4%	63.5%
Total		Count	20	104
		Expected Count	20.0	104.0
		% within Gender	19.2%	100.0%
		% within BMI Category	100.0%	100.0%
		% of Total	19.2%	100.0%

The table shows that 16.3% of the HIV-positive patients are underweight while 37.5%, 37.5%, 26.9%, and 19.2% normal weight, overweight, and obsessed, respectively. Also, male Patients have 36.5% whereas the percentage for their counterparts is 63.5%.

Table 2: Chi-square test

	Value	DF	Asymp. Sig (2-sided)
Pearson Chi-Square	1.653	3	0.647
Likelihood ratio	1.714	3	0.634
N of Valid cases	104		

The minimum expected count is 6.21. Since the test statistics i.e. Pearson Chi-square = 1.653, df =3 and P value = 0.647, we fail to reject the null hypothesis at 1% level of significance and conclude that there is no significant between gender and BMI (i.e. is independent on gender).

Table 4: Symmetric measures

		Value	Approximate Significant
Nominal by normal	Phi	0.126	0.647
Likelihood ratio	Cramer's V	0.126	0.647
N of Valid cases		104	

To quantify the direction and strength of the relationship between the Body Mass Index and gender, we use Cramer's V statistics = 0.126 which shows that there exists a weak positive relationship between the two variables and its corresponding P-value supports our former decision i.e. there is no relation between Body Mass Index and gender.

Table 5 shows the average: height, BMI, and weight values for the 101 HIV-positive patients each with their corresponding standard deviation. Before the sample size was 104, but due to the presence of significant outliers, hence, three cases were removed.

Table 5: Descriptive statistics

	Mean	Standard deviation	N
Height	162.86	13.79	101
BMI	24.24	6.03	101
Weight	64.47	16.77	101

Table 6: Correlation results

		Height	**BMI**	**Weight**
Pearson	Height	1.000	-.102	.495
Correlation	BMI	-.102	1.000	.796
	Weight	.495	.796	1.000
Sig. (1-tailed)	Height	.	.154	.000
	BMI	.154	.	.000
	Weight	.000	.000	.000
N	Height	101	101	101
	BMI	101	101	101
	Weight	101	101	101

Table 6 shows the correlation between height and itself =1, height and BMI = -0.102 and also between height and weight = 0.495.

Table 7 presents a summary of the model where: R- which is called the correlation coefficient equal to 0.957 and this proves a perfect positive linear relationship between dependent(height) and independent variables (BMI and weight). The coefficient of contingency denoted by R^2= 0.916 portrays that 91.6% of the variation in height is explained by BMI and weight. Therefore, the contribution of BMI and weight is statistically significant. The standard error of the estimate gives the error of prediction and its value is 4.02984, which means in every estimate of height, we could be wrong by 4.03. The Durbin-Watson statistic, with its value equal to 1.347 implies that there exist independent observations (no Autocorrelation).

Table 7: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.957	.916	.915	4.02984	1.473

**a. Predictors: (Constant), Weight, BMI, b = dependent variable: height

Table 8: Analysis of variance report

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	17422.574	2	8711.287	536.421	.000
	Residual	1591.485	98	16.240		
	Total	19014.059	100			

a. Dependent Variable: HEIGHT, b. Predictors: (Constant), WEIGHT, BM, Table 4.8 provides the model components whereby:$\alpha = 154.611, \beta_{1=} - 3.094$ and β_2 = 1.292.Hence, the model is express mathematically as: Height= 154.611 - 3.94(BMI) + 1.292 (weight).

Table 9: Values of coefficients

Model		Unstandardized Coefficients		Standardized T Coefficients		Sig.	Collinearity Statistics
		B	Std. Error	Beta			Tolerance
1	Constant	154.611	1.724		89.683	.000	
	BMI	-3.094	.110	-1.352	-28.032	.000	.367
	Weight	1.292	.040	1.571	32.566	.000	.367

Model		Collinearity Statistics
1	(Constant)	
	BMI	2.725
	WIGHT	2.725

The table presents the measure of association between the independent variables (BMI and weight) in which the VIF statistic =2.725 signals the absence of multicollinearity between the independent variables.

The research purports to study Body Mass Index and its influence on HIV-positive patients in that a simple random sample of 104 forms for the patients was taken. 66.5% of the patients were females, 36.5% were males. Likewise, 16.3%, 37.5%, 26.9% and 19.2% were underweight, normal weight, overweight, and obese, respectively. Hence, only 37.5% were normal weight; consequently, in aggregate 62.5% were abnormal weight. Moreover, 26.9% and 19.2% were overweight and obese severally. While 19.2% of the vulnerable population were underweight, this was different from the olden societal ideology, i.e. those having HIV tend to be lesser weight. Therefore, they have named the virus " KANJAMAU". Last but not least, the study comes up with the following model to estimate the height when the BMI and weight are known: height= 154.611 - 3.94(BMI) + 1.292 (weight).

4.0 Conclusions

From the analyzed results, it can be concluded that there is a statistically significant linear relation between the height and weight of HIV-positive patients. However, the study prevails that Body Mass Index does not depend on gender; that is to say, Body Mass Index has nothing to do with gender. Additionally, there is no significant difference in the BMI of male and female patients. Contrary, the study finalizes that Body Mass Index depends on the age of the HIV-positive patients; that is, there exists a linear relation between Body Mass Index and the age of HIV-positive patients.

In response to those problems, our study proposes to recommend the use of BMI, as it is the only way to tell whether you are at a normal weight, overweight, underweight, or obese. It measures your weight about your height and provides a score to help place you in a category, namely, (i) Normal weight: BMI of 18.5 to 24.9, (ii) Overweight: BMI of 25 to 29.9 and (iii) Obesity: BMI of 30 to above.

Also, there is a need to simultaneously address the two extreme weight problems in this vulnerable population by educating them on the benefits of avoiding tobacco, engaging in physical activities and raising awareness about feeding on a balanced diet. Finally, there is a need for the government, religious and traditional rulers as well as society at large, to consolidate and implement pre-marital medical screening, to terminate or reduce the propagation of HIV disease in society, as shown by the research 62.5% of the HIV positive patients are weighty. Hence we cannot identify, by our own naked eyes, that a person has HIV.

5.0 References

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Declarations

The authors declare that they have no conflict of interest.

Data availability

All data used in this study will be readily available to the public.

Consent for publication

Not Applicable

Availability of data and materials

The publisher has the right to make the data Public.

Competing interests

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Authors' contributions

UAI, NM, ASM, and AL were involved in design, writing and data analysis.