JOURNAL OF BIOMEDICAL INVESTIGATION (JBI) VOLUME 12 NUMBER 2: JULY-AUGUST 2024

# RELATIONSHIP BETWEEN PHYSICAL ACTIVITY AND BODY COMPOSITION OF A COHORT OF CLINICAL UNDERGRADUATES OF THE UNIVERSITY OF BENIN

**Authors:**
Okhuahesuyi, E.; Daodu, C.M.; Oghumu, S.N.

**Authors' Affiliation:**
Department of Physiotherapy, School of Basic Medical Sciences. College of Medical Sciences, University of Benin, Edo State, Nigeria

***Corresponding author**:
S. N. Oghumu,
Department of Physiotherapy,
School of Basic Medical Sciences,
University of Benin, Benin, Edo State, Nigeria.
Email: nickyyivieosa@gmail.com

*Received: 09/8/2024; accepted for publication 31/8/2024*

## ABSTRACT

**Background of the study:** Physical activity and healthy body composition are crucial for the overall health and well-being of students of healthcare professions, who are being trained as future advocates of healthcare.

**Aim:** This study investigated the relationship between Physical activity and body composition of final year clinical students of Basic Medical Sciences of the University of Benin, Nigeria.

**Methods:** This is a cross-sectional study in which 163 participants were recruited using consecutive sampling technique. The participants were drawn from departments in school of basic medical sciences including Physiotherapy, Nursing, and Medical Laboratory Science. The International Physical Activity Questionnaire (IPAQ) was used to assess physical activity levels, which were categorized as low, moderate, or high. Anthropometric measurements of weight, height, waist circumference, and hip circumference were taken to calculate body composition parameters such as Body Mass Index (BMI), Waist to Hip Ratio (WHR), and waist-to-stature ratio (WSR). Data was summarized using descriptive statistics of mean, standard deviation, frequencies, percentages; and analyzed using inferential statistics of Pearson Product Moment Correlation coefficients and chi-square. Level of significance was set at $<0.05$.

**Results:** Half (50.3%) of the participants had low physical activity levels, 24.5% had moderate levels, and 25.2% had high levels. Physical Activity levels had a significant negative correlation with BMI ($r=-0.538$, $p<0.001$) and weight ($r=-0.390$, $p<0.001$). A significant negative correlation was also found between physical activity levels and waist circumference ($r=-0.158$, $p=0.04$). However, no significant correlations were found between Physical activity levels and each of age and WHR. No significant ($>0.05$) gender-based correlation was found between physical activity levels and body composition.

**Conclusion:** The findings suggest that physical activity is associated with improved body composition, particularly lower BMI, weight, and waist circumference, among final year clinical students of the University of Benin. Promoting physical activity programs and maintaining healthy body composition may be beneficial for this population of future healthcare professionals.


**Keywords:** *Physical Activity, Body composition, Clinical students, Body Mass Index, Waist circumference.*

## INTRODUCTION

A healthy lifestyle has been reported to reduce the risk of developing lifestyle diseases such as diabetes, obesity, and cardiovascular disease.[1-3] The World Health Organization (WHO) has established guidelines for sustaining physical and mental well-being, encompassing general, age, pregnancy, disease, and disability-specific interventions.[4] Generally, the WHO recommends that individuals should engage in 150–300 minutes per week of moderate

exercise or 75–150 minutes per week of vigorous exercise.[4] Physical Activity (PA) is defined as bodily movements produced by skeletal muscles resulting in energy expenditure. Activities such as walking, gardening, jogging, climbing stairs, or playing soccer are regarded as physical activities.[5]

Engaging in PA is linked to a broad range of health benefits, including healthy growth, development of the musculoskeletal and cardiorespiratory systems, maintenance of energy balance, improved well-being, and enhanced strength and flexibility across all age categories.[6] Physical Activity also influences body composition and weight gain.[7] Body composition, a key factor in physical fitness, describes the body's relative amounts of fat and fat-free mass, encompassing muscle, water, and bone.[8]

Body composition plays a significant role in the classification of obesity, nutritional status, exercise-related gains, and overall health. Body Mass Index (BMI) is fundamentally employed as a means of evaluating weight status, despite it not distinguishing between different components of body mass.[9] This limitation is particularly relevant for physically active individuals, who typically have higher body density and fat-free mass than the general population.[10]

In comparison to BMI, waist-to-stature ratio and Waist Circumference (WC) are considered more sensitive and discriminatory as early indicators of health-related concerns.[11]

There is a direct correlation between higher body fat percentage (%BF) and increased risk of metabolic and cardiovascular diseases.[12] Hence, body composition assessment is crucial for monitoring performance and training in the athletic community and assessing the general population's health status. Regular Physical Activity has been shown to enhance body composition and weight control, thereby reducing the prevalence of chronic diseases.[13]

Despite the benefits of PA, 28% of adults globally do not meet the WHO's minimum PA recommendations.[14] Evidence suggests a relationship between PA and %BF, though prior research has shown inconsistent results across different age groups. An inverse relationship between PA and BF% was observed in middle-aged adults due to reduced metabolic rates associated with aging.[15] However, the relationships between PA and %BF have found to be comparable among young adults.[16]

Furthermore, studies on body composition have predominantly considered BMI, often overlooking other significant metrics. The significance of comprehensive body composition metrics early in adulthood has not been fully explored, and existing studies have produced inconsistent results.[16] More studies on body composition variables among young adults would provide data to enhance understanding of the interplay between PA and body composition.

Clinical students are categories of young adults who are being trained as future healthcare advocates. This student population experience high levels of stress due to their busy schedules and heavy workloads, leading to a decline in physical fitness shortly after enrolling in medical college.[17] Given that clinical students are future health promotion advocates and

crucial to the sustainable development of the medical and health fields, their physical fitness warrants attention. Therefore, this study was designed to investigate the relationship between PA and body composition of final-year clinical students of Basic Medical Sciences at the University of Benin.

## MATERIALS AND METHOD

This study was a cross-sectional design. Participants were final year clinical students drawn from the departments of Physiotherapy, Nursing, and Medical Laboratory Science in the School of Basic Medical Science of the University of Benin. Inclusion criteria were only apparently healthy male and female students that were not undergoing any medical treatment or diet related to body weight management. Participants with acute or chronic conditions like hypothyroidism, Type II Diabetes and those unwilling to participate were excluded from the study.

**Sampling and Study Design:**

Participants were recruited using consecutive sampling technique. The sample size was determined using Taro Yamane sample determination formula for a known population given by $n = N/(1+N[e]^2))$[18],

Where: n= minimum sample size required,

N=sample population=274 students from the listed departments,

e = margin of error=0.05.

Thus, $n = 274/(1+274[0.05]^2))$

$=162.61=163$.

Hence, one hundred and sixty-three participants who were readily available and agreed to participate were recruited for this study.

**Ethical Considerations:**

The ethical approval for this study was sought and obtained from the Ethical and Research Committee of College of Medical Sciences, University of Benin, Edo state. Participants' consents were obtained, privacy was ensured, and they were briefed on the study's purpose before participation.

**Procedure for Data Collection**

Participants were given consent form and briefed on the research aim before questionnaires were issued to them. Copies of the questionnaires were distributed to the participants who were allowed sufficient time to complete the questionnaires and retrieved before assessing the anthropometric parameters of weight, height, waist and hip circumferences of participants.

The questionnaire distributed to participants was the International Physical Activity questionnaire (IPAQ) which was used to assess participants' levels of PA. The IPAQ is an instrument designed primarily for population surveillance of PA among adults (age 15 and above).[19] Its development commenced in Geneva in the year 1998 and was followed by extensive reliability and validity testing across 12 countries in 2002. The finding suggests that it has acceptable measurement properties for use in many settings and different languages and is suitable for population-based prevalence studies of participation in PA. The IPAQ

used in this study has 7 items providing information on time spent in moderate to vigorous intensity PA and in sedentary activities during the last 7 days. The IPAQ has high reliability[19] of 0.80. The PA level in this study was reported in categories (low activity levels/inactive, moderate activity levels, or high activity level) and as a continuous variable (MET minutes/week) according to the scoring system provided by IPAQ. To get the continuous variable score from the IPAQ (MET minutes/week) we considered walking to be 3.3 METs, moderate PA as 4.0 METs, and vigorous PA to be 8.0 METs. Total MET minutes of PA a week was calculated by adding MET minutes achieved in each category (walking, moderate activity and vigorous activity).

The mechanical weighing scale was used to assess participants' weights to the nearest 0.1Kg. Participants were instructed to stand erect on the weighing scale bare footed with object free light clothing shots. The researcher read the weighing scale and record the values obtained. The height meter was used to measure the height of the participants to the nearest 0.1 metre (m). The participants were instructed to stand erect by the height metre during which the height scores were obtained and recorded. The BMI of the participants were calculated using the formula BMI=weight/height$^2$ in Kg/m$^2$.

Waist circumference was measured according to the procedure described by the National Heart, Lung, and Blood Institute of North American Association for the Study of Obesity.[20] To measure the WC, the researcher located the upper hip bone and the top of the right iliac crest of each participant. Thereafter, placed a measuring tape around the abdomen at the level of the iliac crest. The researcher ensured that the tape is snugged, not compressing the skin, and paralleled to the floor before reading the tape measure at the end of the participant normal expiration to the nearest 0.5cm. The obtained values were converted to the nearest 0.5m. Hip Circumference (HC) was measured with a tape measure at the level of the widest circumference of the participants' hip, which is usually the widest level of the iliac crest of the participants. The readings were obtained in the nearest 0.5cm and converted to the nearest 0.5m for recording. The WHR of participants was calculated as WC/HC.

**Data Analysis:**

Data were summarized using frequencies, percentages, means and standard deviation. Inferential statistics of Pearson Moment correlation coefficient was used to assess the relationships between PA and each of age, weight, BMI, WC and WHR of the participants. Also, Chi-square statistics was used to assess the association between PA and gender. Level of significance was set at $p < 0.05$.

## RESULTS

One hundred and sixty-three participants completed this study. 89(54.6%) of the respondents were males and 74(45.4%) were females. 89(54.6%) of the respondents were students of physiotherapy department, 40(24.5%) were nursing students and 34(20.9%) were medical laboratory science students. A significant majority 141(86.5%) of the respondents were Christians, while 22(13.5%) were Muslims. 57(350%) of the

respondents had normal weight, 56(34.4%) were overweight while 38(23.3%) were obese (Table 1). The ages of the respondents ranged from 21 to 30 years with a mean age of 25.50 ± 2.58 years. The weight of the respondents ranged from 40 to 106Kg with a mean weight of 73.53± 13.11 Kg. The height of the respondents ranged from 1.47m to 1.96m with a mean height of 1.68 ±0.11m. The BMI of the respondents ranged from 14.84Kg/$m^2$ to 36.21Kg/$m^2$ with an average BMI of 26.04± 4.96 Kg/$m^2$. The waist circumference of the respondents ranged from 0.63m to 1.04m with a mean of 0.82±0.08m. The hip circumference ranged from 0.73m to 1.50m with a mean of 1.00± 0.14m. The WHR ranged from 0.69m to 0.98m with a mean of 0.83±0.08m (Table 2); 82(50.3%) of the respondents had low PA level, 41(25.2%) had high PA level and 40(24.5%) of the respondents had moderate PA level. The mean IPAQ Score was reported to be 2019.88 ± 2997.63 (Table 3). There was a negative significant relationship (r= -0.538, p=<0.001) between PA and BMI. There was a negative significant relationship (r= -0.390, p=<0.001) between PA and the weight of the respondents. There was a negative significant relationship (r= -0.158, p=0.04) between PA and waist circumference. However, there was no significant relationship (p>0.05) between PA and age. There was also no significant relationship (p>0.05) between PA and waist-hip ratio of the respondents (Table 4).

Also, the study found that there was no significant relationship ($X^2$=4.821, p=0.09) between the PA level and the gender of the respondents (Table 5)

**Table 1: Socio-demographic parameters of the respondents** **n=163**

| Variable | Category | Frequency | Percentages |
|---|---|---|---|
| Gender | Male | 89 | 54.6 |
| | Female | 74 | 45.4 |
| Departments | MLS | 34 | 20.9 |
| | Nursing | 40 | 24.5 |
| | Physiotherapy | 89 | 54.6 |
| Religion | Christian | 141 | 86.5 |
| | Muslims | 22 | 13.5 |
| | Underweight | 12 | 7.4 |
| BMI | | | |
| | Normal weight | 57 | 35.0 |
| | Overweight | 56 | 34.4 |
| | Obese | 38 | 23.3 |

**Keys:** MLS=Medical Laboratory Science; BMI= Body mass index

**Table 2: Physical characteristics of the respondent**

| Variable | Minimum | Maximum | Mean ± SD |
|---|---|---|---|
| Age (years) | 21 | 30 | 25.50 ± 2.58 |
| Weight (Kg) | 40 | 106. | 73.53 ± 13.11 |
| Height (m) | 1.42 | 1.96 | 1.68 ± 0.11 |
| BMI ($Kg/m^2$) | 14.84 | 36.21 | 26.04 ± 4.96 |
| Waist circumference (m) | 0.63 | 1.04 | 0.82 ± 0.08 |
| Hip circumference (m) | 0.73 | 1.50 | 1.00 ± 0.14 |
| WHR | 0.69 | 0.98 | 0.83 ± 0.08 |

**Keys:** BMI= Body Mass Index; WHR=Waist to Hip Ratio

**Table 3: Physical Activity level of the respondents**

| Variable | Category | Frequency | Percentages |
|---|---|---|---|
| Physical Activity | Low | 82 | 50.3 |
| | Moderate | 40 | 24.5 |
| | High | 41 | 25.2 |
| | **Mean ± SD** | | |
| IPAQ Score | 2019.88 ± 2997.63 | | |

**Table 4: Pearson correlation coefficient between Physical Activity and BMI, weight, waist circumference, waist-hip ratio of respondents**

| | R | P |
|---|---|---|
| **Physical Activity * BMI** | -0.538 | <0.001 |
| **Physical Activity * weight** | -0.390 | <0.001 |
| **Physical Activity * Age** | 1 | 0.173 |
| **Physical Activity * WC** | -0.158 | 0.04 |
| **Physical Activity * WHR** | -0.051 | 0.518 |

**Keys:** BMI=Body mass index, WC=Waist circumference; WHR=Waist to hip ration

**Table 5: Chi-square statistics between Physical Activity level and gender**

| | Male | Female | $X^2$ | P |
|---|---|---|---|---|
| **Low** | 50 | 32 | 4.821 | 0.09 |
| **Moderate** | 16 | 24 | | |
| **High** | 23 | 18 | | |

## DISCUSSION

It is well recognized that a preventable risk factor for non-communicable diseases like diabetes mellitus, hypertension, and others is physical inactivity. Increased physical fitness, a better capacity for stress management, and stronger self-esteem are all brought about by regular Physical Activity.[21] This study was evaluated the relationship between PA levels and body composition of final year clinical students of Basic Medical Sciences, University of Benin, Nigeria.

The findings of this study of more male medical student than female agrees with the report of a similar study by Yadav et al that there were more male students as compared to s students undergoing medical training.[22] More than half of the respondents of this study had low PA level which is not in tandem with the findings by Yadav et al, although, in both studies, high PA level had the least prevalence among the respondents. However, the finding of high prevalence of low PA in this study is consistent with the finding from a similar study done by Ashok et al which reported high prevalence of students with low PA.[23] On the other hand, this present study is at variance with the findings from a similar study by Nada et al that reported higher prevalence of high PA among medical students in Morrocco.[24] Reduced PA in late teens or early adulthood which are active years of life might induce sedentary behavior in middle age and increase the risk of non-communicable diseases such as Diabetes mellitus, hypertension, coronary heart disease among others. These findings of this study underscore the importance of promoting regular PA among students to manage body weight and reduce central obesity, both of which are critical in preventing non-communicable diseases such as diabetes, hypertension, and coronary heart disease. Given that over half of the respondents had low PA levels, there is a need for interventions aimed at increasing PA among students, such as incorporating more physical activities into their daily routines or academic schedules.

The findings of this study that PA was negatively correlated with BMI implies that an increase in the PA levels resulted in a decrease in the BMI of the respondents and vice versa. This finding is at variance with

the findings of Yadav et al which reported that there was no significant relationship between PA and BMI. Similarly, Goel et al and Preto et al found no association between PA and BMI.[25, 26] The findings of this present study is consistent with the report of You et al that PA and BMI are correlated, although weakly.[8] Also, the finding of this study of negative relationship between PA and the weight of the respondents meant that as PA levels of the respondents increases, weight decreases and vice versa. Also, the same interpretation applies to PA levels and WC of the respondents which were negatively related in this study. This finding is consistent with the reports of Yadav et al that found a negative correlation between PA and WC. These insights of relationship between PA and anthropometric parameters of weight, BMI and WC can inform health promotion strategies targeting these characteristics of respondents to enhance their PA levels and overall health. However, PA levels of respondents were comparable to age and WHR. The finding of no relationship between PA and WHR in this study contrasts with the finding of Yadav et al which reported a negative correlation between PA and WHR. Therefore, respondents age and WHR do not influence their PA level.

In Summary, this study highlights the critical need for comprehensive strategies in medical education to promote PA and healthy body composition. By adopting these recommendations, medical schools can foster healthier lifestyles among students, equipping them to become effective advocates for active living in their professional and personal lives. These changes could lead to significant benefits for both future healthcare professionals and the patients they will serve. Notably, over half of the participants had low PA levels, which is concerning given their impending roles as healthcare providers. To address these issues, the researchers recommend implementing structured PA interventions in medical curricula, incorporating comprehensive body composition assessments into routine health screenings, and providing targeted education on the importance of PA. Additionally, establishing mentorship programs and peer support networks, advocating for institutional policy changes to promote PA, and conducting longitudinal studies to understand long-term impacts are advised. Future studies should explore the underlying factors contributing to the low PA levels observed and evaluate the effectiveness of targeted interventions to increase PA among university students.

## CONCLUSION

This study highlights significant correlations between PA levels and BMI, weight, and waist circumference among final year clinical students. However, no significant relationships were found between PA levels and age or WHR. There was no gender-based influence of PA on anthropometric parameters of respondents, suggesting that all students can benefit equally from regular PA.

## REFERENCES

1. Cleven L, Krell-Roesch J, Nigg CR, Woll A. The association between Physical Activity with incident obesity, coronary Heart Disease, diabetes and hypertension in

adults: a systematic review of longitudinal studies published after 2012. BMC public health. 2020;20(1):1-15.

2. Anderson E, Durstine JL. Physical Activity, exercise, and chronic diseases: A brief review. Sports Medicine and Health Science. 2019;1(1):3-10.

3. Myers J, Kokkinos P, Nyelin E. Physical Activity, cardiorespiratory fitness, and the metabolic syndrome. Nutrients. 2019;11(7):1652.

4. Okely AD, Kontsevaya A, Ng J, Abdeta C. 2020 WHO guidelines on Physical Activity and sedentary behavior. Sports Medicine and Health Science. 2021;3(2):115-118.

5. Bull FC, Al-Ansari SS, Biddle S, Borodulin K, Buman MP, Cardon G, et al. World Health Organization 2020 guidelines on Physical Activity and sedentary behaviour. British journal of sports medicine. 2020;54(24):1451-1462.

6. Landry BW, Driscoll SW. Physical Activity in children and adolescents. PM&R. 2012;4(11):826-832.

7. Yoshioka M, Ayabe M, Yahiro T, Higuchi H, Higaki Y, St-Amand J, et al. Long-period accelerometer monitoring shows the role of Physical Activity in overweight and obesity. International journal of obesity. 2015;29(5):502-508.

8. You HW, Tan PL, AF ML. The relationship between Physical Activity, Body Mass Index and body composition among students at a pre-university centre in Malaysia. IIUM Medical Journal Malaysia. 2020;19(2).

9. De Lorenzo A, Bianchi A, Maroni P, Iannarelli A, Di Daniele N, Iacopino L, et al. Adiposity rather than BMI determines metabolic risk. International journal of cardiology. 2013;166(1):111-117.

10. Klungland Torstveit M, Sundgot-Borgen J. Are under- and overweight female elite athletes thin and fat? A controlled study. Med Sci Sports Exerc. 2012;44(5):949-57.

11. Ashwell M, Gunn P, Gibson S. Waist-to-height ratio is a better screening tool than waist circumference and BMI for adult cardiometabolic risk factors: systematic review and meta-analysis. Obesity reviews. 2012;13(3):275-286.

12. Chuang HH, Li WC, Sheu BF, Liao SC, Chen JY, et al. Correlation between body composition and risk factors for cardiovascular disease and metabolic syndrome. Biofactors. 2012;38(4):284-291.

13. Can S, Demirkan E, Ercan S. The Effects of Exercise Preferences on Body Fat and Body Mass Index by Self-report," Universal Journal of Educational Research. 2019;7(1):293 – 297.

14. Zou Q, Su C, Du W, Ouyang Y, Wang H, Wang Z, et al. The association between Physical Activity and body fat percentage with adjustment for Body Mass Index among middle-aged adults: China health and

nutrition survey in 2015. BMC public health. 2020;20:1-12.

15. St-Onge MP, Gallagher D. Body composition changes with aging: the cause or the result of alterations in metabolic rate and macronutrient oxidation?. Nutrition. 2010;26(2):152-155.

16. Correa-Rodríguez M, Rueda-Medina B, González-Jiménez E, Schmidt-RioValle J. Associations between body composition, nutrition, and Physical Activity in young adults. American Journal of Human Biology. 2017;29(1):e22903.

17. Hou Y, Mei G, Liu Y, Xu W. Physical Fitness with Regular Lifestyle Is Positively Related to Academic Performance among Chinese Medical and Dental Students. Biomed Res Int. 2020;2020:5602395.

18. Yamane T (1967). Statistics: An Introductory Analysis, 2nd Edition, New York: Harper and Row.

19. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International Physical Activity Questionnaire: 12-country Reliability and Validity. Medicine & Science in Sports & Exercise. 2003;35(8):1381 – 1395.

20. NHLBI Obesity Education Initiative. The practical guide to the identification, evaluation and treatment of overweight and obesity in adults (NIH, 2000).

21. World Health Organization. *Overweight and obesity*. Geneva: World Health Organization; (2018). Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.

22. Yadav G, Bodat S, Siwach I, Sachdeva K, Chauhan N. Physical Activity and its relation with body composition among undergraduate medical students in Delhi: a cross sectional study. International Journal of Community Medicine and Public Health. 2020;7(11): 4530.

23. Ashok P, Kharche JS, Raju R, Godbole G. Metabolic equivalent task assessment for Physical Activity in medical students. National Journal of Physiology, Pharmacy and Pharmacology. 2017;7(3):236.

24. Nada O, Serhier Z, Housbane S, Othmani MB. Physical Activity Among Medical Students in Casablanca, Morocco, Imperial. J Interdisciplinary Res. 2016;2:566-76.

25. Goel MK, Roy P, Rasania SK, Bachani D. A cross-sectional study on leisure time management and Physical Activity index among female adolescent medical students in Delhi. Indian Journal of Youth and Adolescent Health. 2014;1:18-26.

26. Preto L, Novo AFMP, Mendes M. Relationship between Physical Activity, muscle strength and body composition in a sample of nursing students. Revista de Enfermagem Referência. 2016;4(11):81-89.