

The Effects of An Eight-week Fitness Class on Body Composition and Fitness among African Americans

Hsin-Yi Liu*, Mark Langley

Department of Kinesiology and Recreation Administration, North Carolina Central University, Durham, NC 27707, USA

*Corresponding author: hliu@nccu.edu

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Abstract Cardiovascular disease (CVD) remains a leading cause of morbidity and mortality among African Americans while compared to other racial and ethnic groups. Sixty-three African American college students were recruited from North Carolina Central University (NCCU), a Historically Black College and University (HBCU). All students participated in an eight-week fitness course designed and led by a certified fitness instructor at NCCU. This study assessed the effectiveness of this eight-week fitness program (NCCU Active8 Program) to improve cardiovascular fitness, muscular endurance, and reduce the CVD risk factors including blood pressure, BMI, and body fat percentage (BF%). Pre- and post-measurements were compared with a paired-t test at significant level of $p=0.05$. Students' health behaviors, such as alcohol, tobacco, and vegetable consumptions, and activity level were also assessed with a modified Young Adult Health Behavior Questionnaire. Our results showed that there were significant changes in their blood pressure, BMI, muscular endurance, and cardiovascular fitness after completing the program. However, we did not see significant change in their BF% or health behaviors. Therefore, this 8-week fitness program was effective in reducing several CVD risk factors and improving muscular fitness.

Keywords: Body Composition, Muscle Fitness, African Americans, Cardiovascular Disease, Obesity

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1. Introduction

Obesity is a growing public health crisis in the United States that disproportionately affects African American people and is associated with a substantial disease burden due to an increased risk for multiple complications, including cardiovascular and metabolic diseases [1,2]. In Furthermore, the disproportionate burden of Cardiovascular disease (CVD) among African American populations has been extensively documented [3,4,5]. Key contributing factors include elevated body mass index (BMI), increased adiposity, hypertension, and physical inactivity—all of which are well-established determinants of cardiovascular risk [6-8]. From 2017 to 2020, the prevalence of obesity among U.S. adults aged 20 years and older reached 41.9%, with significantly higher rates observed among non-Hispanic Black adults [9,10]. These health disparities are shaped by a multifactorial interplay of genetic predispositions, socioeconomic barriers, and behavioral patterns, highlighting the critical need for effective, culturally responsive prevention strategies. Lifestyle factors such as diet and physical activity are central to cardiovascular health. However, physical

inactivity remains prevalent across the lifespan and is particularly concerning during adolescence and young adulthood. As a modifiable risk factor, physical inactivity—alongside smoking, obesity, and hypertension—continues to pose a major public health challenge.

Previous research has emphasized the importance of promoting physical education and physical activity during adolescence and young adulthood as a means of reducing cardiovascular disease (CVD) risk [11,12,13] [14,15,16]. Additionally, studies have examined culturally tailored interventions aimed at improving cardiovascular health within African American communities [17,18]. Despite these efforts, there remains a notable gap in recent literature regarding the effectiveness of physical education programs implemented at Historically Black Colleges and Universities (HBCUs) in mitigating CVD risk among African American students. This is particularly important given that the early college years represent a critical period characterized by significant increases in body fat percentage and weight gain [12,13,14]. Therefore, the present study aims to: 1) evaluate the effectiveness of an eight-week physical education program in reducing CVD risk factors, and 2) assess improvements in muscular endurance, flexibility, and cardiovascular fitness resulting from participation in this program.

2. Methodology

2.1. Participants

Sixty-three African American college students, aged 18–25, were recruited from North Carolina Central University, a Historically Black College and University (HBCU). Eligibility criteria required participants to be free of chronic diseases, including type 2 diabetes, hypertension, and cardiovascular disease (CVD). Prior to participation, all individuals provided informed consent, as mandated by the Institutional Review Board (IRB).

2.2. Data Collection

The Baseline measurements were obtained upon enrollment, including body weight (lb), height (in), body mass index (BMI), waist and hip circumferences (in), blood pressure, cardiovascular fitness, and body fat percentage (%). Cardiovascular fitness was evaluated through with one-minute sit-up and push-up tests and a one-mile run measured in seconds. Flexibility was measured using the sit-and-reach test.

Body composition was assessed using the Bod Pod, which employs whole-body air displacement plethysmography. This method was selected because its measurements closely approximate those obtained via hydrostatic weighing, the established gold standard for body composition assessment, and are more accurate than those from bioelectrical impedance fat analyzers [19]. During testing, participants sat inside a small, egg-shaped chamber for several minutes. To ensure accuracy, participants wore minimal clothing—typically a swimsuit or tight-fitting shorts—and a swim cap to compress hair. They were instructed to remain still and breathe normally throughout the procedure.

In addition, a modified questionnaire of Youth Risk Behavior Surveillance System (CDC, 2023) for young adults (Appendix A), including the questions related to tobacco, alcohol, drug use, body weight, diet, and physical activity, was given to assess any confounding factors that may affect the result besides the exercise program.

2.3. Exercise Program

Participants attended instructor-led physical education classes twice per week for eight weeks. Each session lasted 50 minutes, consisting of a 5-10 minute warm-up followed by a 40-45 minute workout.

During workout sessions, students performed a combination of muscle-strengthening and cardiovascular exercises under the supervision of a certified fitness instructor. The muscle-strengthening routine targeted major muscle groups, including the legs, shoulders, biceps, triceps, chest, abdominals, and lower back. On the first day, students were instructed on proper exercise techniques. During the first week, participants completed one set of 15 repetitions per exercise, progressively increasing to four sets of six repetitions by the eighth week.

Cardiovascular exercises included brisk walking,

cycling, step aerobics, and jogging. Participants performed 20-minute cardio sessions during the first three weeks, progressing to 25 minutes between weeks four and six, and 30 minutes during the final two weeks. Each participant maintained a workout log to record exercise duration and activities completed (Appendix B).

2.4. Quantitative Analysis

Pre- and post-intervention comparisons of anthropometric measurements, body composition, muscular strength, endurance, and post-exercise heart rate were analyzed using paired t-tests. Statistical significance was set at $p \leq 0.05$. All analyses were conducted using IBM SPSS statistical software, version 22.

3. Results

3.1. Initial Assessment

Sixty-three students' data were analyzed. Their mean age was 20.24 ± 2.09 years old. The average BMI of the students was 26.86 ± 5.59 , which indicated increased risk of CVD based on the BMI classification for adults (Table 1).

Table 1. BMI categories for adults

BMI Categories	BMI	Health Risk
Obese	≥ 30	High
Overweight	≥ 25 and < 30	Increased
Normal	≥ 18.5 and < 25	Average
Underweight	< 18.5	Increased

Note. CDC, 2024.

Their average BF% was 28.22 ± 13.00 , which was considered dangerously high among age 20-29 years old (Table 2).

Table 2. General body fat percentage categories

Category	Percentage
Low	Under 14%
Excellent	14 to 16.5%
Good	16.6 to 19.4% v
Fair	19.5 to 22.7%
Poor	22.8 to 27.1%
Dangerously High	Over 27.2%

Note. InBody USA, 2025.

3.2. Cardiovascular Risk Assessment

When comparing pre- and post- cardiovascular risk factors data, there was significant increase in BMI ($p=0.01$), and body weight ($p=0.02$), but significant decrease in systolic blood pressure ($p=0.05$). However, there was no significant change in waist circumferences ($p=0.53$), hip circumferences ($p=0.12$), waist to hip ratio (WHR) ($p=0.27$), or body fat percentage (BF%) ($p=0.72$) (Table 3).

Table 3. Pre- and Post- Cardiovascular Risk Factors Compared with Paired-t Test (*p ≤ 0.05)

Parameter		Mean	SD	p
Systolic BP	Pre	124.44	12.92	.048*
	Post	117.38	16.59	
Diastolic BP	Pre	76.63	13.24	.042*
	Post	69.94	7.69	
Waist Circumference (in)	Pre	31.53	5.39	.532
	Post	31.12	4.83	
Hip Circumference (in)	Pre	39.87	5.74	.123
	Post	41.09	5.13	
Waist to Hip ratio	Pre	.80	.14	.270
	Post	.76	.05	
Body Weight (lb)	Pre	163.34	43.83	.017*
	Post	165.13	44.41	
Body Mass Index	Pre	26.86	5.59	.013*
	Post	27.16	5.72	
Body Fat Percentage (%)	Pre	28.22	13.00	.715
	Post	27.80	12.14	

3.3. Fitness Assessment

When comparing pre- and post- cardiovascular fitness data, there were significant improvements in one minute push up test ($p < 0.01$), one minute sit up test ($p < 0.01$), and time for one mile run time ($p < 0.01$). However, there was no significant change in their sit-and-reach flexibility results ($p = 0.17$) (Table 4).

Table 4. Pre- and Post- Cardiovascular Fitness Compared with Paired-t Test (*p ≤ 0.05)

Parameter		Mean	SD	p
Push Up (Repetitions)	Pre	25.00	10.55	<.001*
	Post	31.83	12.39	
Sit Up (Repetitions)	Pre	33.10	11.20	<.001*
	Post	42.79	12.01	
Flexibility (Inches)	Pre	2.34	2.79	.168
	Post	3.06	2.59	
1 Mile Run (Seconds)	Pre	809.32	178.19	.003*
	Post	748.51	212.16	

3.4. Health Behavior Assessments

Our results showed no significant change to the students' answers to the modified questionnaire of health behaviors, including alcohol, tobacco, vegetable consumptions after they completed this 8-week fitness course. Therefore, incorporating sessions focused on nutrition education, behavioral counseling, and motivational strategies may be needed.

4. Discussion

The purpose of this study was to assess the effectiveness of the NCCU Active8 Program offered in a HBCU in improving in key health indicators, including blood pressure, BMI, cardiovascular fitness, and muscular performance. The result of our study showed a structured and supervised fitness program can positively influence cardiovascular health indicators, including blood pressure,

BMI, cardiovascular fitness, and muscular endurance, which aligned with some previous research findings on the effects of moderate to vigorous physical activity [22,23].

Furthermore, significant increased in students' body weight after completion of the program without significant change in students' body fat percentage (BF%) suggested body weight increase was due to the increase of lean muscle mass, which is associated with improved cardiovascular health and muscular fitness [24].

However, students' waist to hip ratio did change significantly, which suggested that the fat distributions in our body take longer time that eight weeks to change, and/or the lack of dietary modifications during the time of participation. BF% reductions and redistribution often require both sustained physical activity and nutritional changes over a longer period [25].

Additionally, the health behavior outcomes, including alcohol use, tobacco use, and vegetable consumption, also did not show significant improvement. These findings suggest that while physical fitness components are modifiable through structured exercise, broader behavioral changes may require a more comprehensive or longer-term approach that includes education, counseling, or policy-level interventions.

Another consideration is the self-reported nature of the health behavior questionnaire, which may have introduced reporting biases or limited sensitivity to detect small changes. Future studies could incorporate more objective measures of health behaviors and consider extending the intervention to include a behavioral or nutritional education component.

Moreover, the context of the intervention—a fitness course led by a qualified instructor within a supportive university environment—likely contributed to the observed improvements. This highlights the potential of using institution-based programs at HBCUs and similar institutions to mitigate health disparities among African American youth.

5. Conclusion

This study found that this NCCU Active8 Program at a Historically Black College and University significantly improved several CVD risk markers, including blood pressure, BMI, cardiovascular fitness, and muscular endurance among African American college students. However, body fat percentage and health behaviors remained unchanged, suggesting that additional or longer interventions may be needed to address these more complex factors.

These results reinforce the importance of institutional support in promoting student health and suggest that fitness programming in college settings, particularly those serving underrepresented populations, can play a critical role in reducing long-term CVD risk.

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Appendix A

Subject # _____

This survey is about health behavior. It has been developed so you can tell us what you do that may affect your health. The information you give will be used to develop better health education for young people like yourself.

DO NOT write your name on this survey. The answers you give will be kept private. No one will know what you write. Answer the questions based on what you really do.

Completing the survey is voluntary. The questions that ask about your background will be used only to describe the types of students completing this survey. The information will **not be used to find out your name. No names will ever be reported.** Make sure to read every question.

1. How old are you? _____ Years old
2. What is your sex?
 - A. Female
 - B. Male

- 3. What is your race? (Select one)
- A. American Indian or Alaska Native
- B. Asian
- C. Black or African American
- D. Native Hawaiian or Other Pacific Islander
- E. White
- F. Hispanic or Latino
- G. Other

The next 4 questions ask about drinking alcohol. This includes drinking beer, wine, wine coolers, and liquor such as rum, gin, vodka, or whiskey. For these questions, drinking alcohol does not include drinking a few sips of wine for religious purposes.

- 4. During your life, on how many days have you had at least one drink of alcohol?
- A. 0 days
- B. 1 or 2 days
- C. 3 to 9 days
- D. 10 to 19 days
- E. 20 to 39 days
- F. 40 to 99 days
- G. 100 or more days

- 5. During the past 30 days, on how many days did you have at least one drink of alcohol?
- A. 0 days
- B. 1 or 2 days
- C. 3 to 5 days
- D. 6 to 9 days
- E. 10 to 19 days
- F. 20 to 29 days
- G. All 30 days

- 6. During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?
- A. 0 days
- B. 1 day
- C. 2 days
- D. 3 to 5 days
- E. 6 to 9 days
- F. 10 to 19 days
- G. 20 or more days

- 7. During the past 30 days, on how many days did you have at least one drink of alcohol on school property?
- A. 0 days
- B. 1 or 2 days
- C. 3 to 5 days
- D. 6 to 9 days
- E. 10 to 19 days
- F. 20 to 29 days
- G. All 30 days

The next 5 questions ask about body weight.

- 8. What is your current body weight: _____lb
- 9. What is your current body height: _____in
- 10. How do you describe your weight?
- A. Very underweight
- B. Slightly underweight
- C. About the right weight
- D. Slightly overweight
- E. Very overweight

11. Which of the following are you trying to do about your weight?
 - A. Lose weight
 - B. Gain weight
 - C. Stay the same weight
 - D. I am not trying to do anything about my weight

12. During the past 30 days, did you exercise to lose weight or to keep from gaining weight?
 - A. Yes
 - B. No

13. During the past 30 days, did you eat less food, fewer calories, or foods low in fat to lose weight or to keep from gaining weight?
 - A. Yes
 - B. No

14. During the past 30 days, did you take any diet pills, powders, or liquids without a doctor's advice to lose weight or to keep from gaining weight? (Do not include meal replacement products such as Slim Fast.)
 - A. Yes
 - B. No

The next 8 questions ask about food you ate or drank during the past 7 days. Think about all the meals and snacks you had from the time you got up until you went to bed. Be sure to include food you ate at home, at school, at restaurants, or anywhere else.

15. During the past 7 days, how many times did you drink 100% fruit juices such as orange juice, apple juice, or grape juice? (Do not count punch, Kool-Aid, sports drinks, or other fruit-flavored drinks.)
 - A. I did not drink 100% fruit juice during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day

16. During the past 7 days, how many times did you eat fruit? (Do not count fruit juice.)
 - A. I did not eat fruit during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day

17. During the past 7 days, how many times did you eat green salad?
 - A. I did not eat green salad during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day

18. During the past 7 days, how many times did you eat potatoes? (Do not count french fries, fried potatoes, or potato chips.)
 - A. I did not eat potatoes during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day

19. During the past 7 days, how many times did you eat carrots?
- A. I did not eat carrots during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day
20. During the past 7 days, how many times did you eat other vegetables? (Do not count green salad, potatoes, or carrots.)
- A. I did not eat other vegetables during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day
21. During the past 7 days, how many times did you drink a can, bottle, or glass of soda or pop, such as Coke, Pepsi, or Sprite? (Do not include diet soda or diet pop.)
- A. I did not drink soda or pop during the past 7 days
 - B. 1 to 3 times during the past 7 days
 - C. 4 to 6 times during the past 7 days
 - D. 1 time per day
 - E. 2 times per day
 - F. 3 times per day
 - G. 4 or more times per day
22. During the past 7 days, how many glasses of milk did you drink? (Include the milk you drank in a glass or cup, from a carton, or with cereal. Count the half pint of milk served at school as equal to one glass.)
- A. I did not drink milk during the past 7 days
 - B. 1 to 3 glasses during the past 7 days
 - C. 4 to 6 glasses during the past 7 days
 - D. 1 glass per day
 - E. 2 glasses per day
 - F. 3 glasses per day
 - G. 4 or more glasses per day

The next 5 questions ask about **physical activity**.

23. On how many of the past 7 days did you exercise or participate in sports activities for at least 20 minutes that made you sweat and breathe hard, such as basketball, jogging, swimming laps, tennis, fast bicycling, or similar aerobic activities?
- A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
 - G. 6 days
 - H. 7 days
24. On how many of the past 7 days did you do stretching exercises, such as toe touching, knee bending, or leg stretching?
- A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
 - G. 6 days
 - H. 7 days

25. On how many of the past 7 days did you walk or bicycle for at least 30 minutes at a time? (Include walking or bicycling to or from class or work.)
- A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
 - G. 6 days
 - H. 7 days
26. On how many of the past 7 days did you do exercises to strengthen or tone your muscles, such as push-ups, sit-ups, or weight lifting?
- A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
 - G. 6 days
 - H. 7 days
27. During this school year, on how many college sports teams (intramural or extramural) did you participate?
- A. 0 teams
 - B. 1 team
 - C. 2 teams
 - D. 3 or more teams

The next 11 questions ask about **tobacco** use.

28. Have you ever tried cigarette smoking, even one or two puffs?
- A. Yes
 - B. No
29. Does either of your parents smoke cigarette?
- A. Yes
 - B. No
30. How old were you when you smoked a whole cigarette for the first time?
- A. I have never smoked a whole cigarette
 - B. 8 years old or younger
 - C. 9 or 10 years old
 - D. 11 or 12 years old
 - E. 13 or 14 years old
 - F. 15 or 16 years old
 - G. 17 years old or older
31. During the past 30 days, on how many days did you smoke cigarettes?
- A. 0 days
 - B. 1 or 2 days
 - C. 3 to 5 days
 - D. 6 to 9 days
 - E. 10 to 19 days
 - F. 20 to 29 days
 - G. All 30 days
32. During the past 30 days, on the days you smoked, how many cigarettes did you smoke per day?
- A. I did not smoke cigarettes during the past 30 days
 - B. Less than 1 cigarette per day
 - C. 1 cigarette per day
 - D. 2 to 5 cigarettes per day
 - E. 6 to 10 cigarettes per day
 - F. 11 to 20 cigarettes per day
 - G. More than 20 cigarettes per day

