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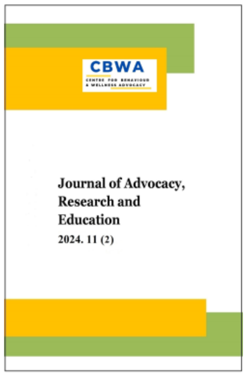
CENTRE FOR BEHAVIOUR & WELLNESS ADVOCACY

Publisher: Centre for Behaviour and Wellness Advocacy, Ghana
Co-publisher: Cherkas Global University, USA
Has been issued since 2014
ISSN 2410-4981. E-ISSN 2508-1055
2024. 11(2): 163-174

DOI: 10.13187/jare.2024.2.163

Journal homepage:
http://kadint.net/our-journal.html



Evaluating Health Markers Response to Aerobic Exercise Among Adult Keep Fit Clubs Members in Ghana: A Paired Analysis Across Genders

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Abstract

The prevalence of physical inactivity among adults and adolescents worldwide is alarmingly high, contributing to increased morbidity and mortality rates. The assessment of physiological and anthropometric markers holds significant implications in light of the global burden of physical inactivity, sedentary lifestyles, and non-communicable diseases. A pre-test post-test control group quasi-experimental design was used to examine participants' health markers response to aerobic exercise among Keep Fit clubs in Accra, Ghana. There was a total of 64 participants, 32 in each training group. Longitudinal data from 12-week intervals was collected on two different occasions to track the changes in the variables over time and among males and females. A paired sample t-test comparison of means was calculated for males and females separately to examine the effectiveness of the exercise protocols on the selected anthropometric and physiological measures. The results showed that males mostly responded to continuous exercise. At the same time, females responded better to single training.

Keywords: Aerobic Exercise, Anthropometric Health Markers, Continuous Training Exercise, One-Time Training, Physiological Health Markers.

1. Introduction

It is established that physical exercise is the most cost-effective preventive measure for public health against diseases and a powerful auxiliary medicine in many cases (Naci, Loannidis, 2015). Engaging in regular exercise offers a myriad of benefits that contribute to overall well-being and longevity. One of the primary advantages of regular physical activity is its positive impact on cardiovascular health (Sydo et al., 2014). Physical activity burns calories and increases metabolic rate, which can help individuals achieve and maintain a healthy body weight. Obesity is a significant risk factor for various chronic diseases, including type 2 diabetes, certain types of cancer, and osteoarthritis (Hruby, Hu, 2015).

Aerobic exercises, such as brisk walking, running, cycling, or swimming, have been shown to improve cardiovascular fitness by strengthening the heart muscle and improving blood circulation (Nystoriak, Bhatnagar, 2018). This, in turn, can reduce the risk of developing cardiovascular diseases, including heart attacks and strokes (Kyu et al., 2016). Furthermore, regular aerobic exercise plays a vital role in maintaining a healthy weight and preventing obesity (Swift et al., 2018).

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Received: 27 June 2024 Revised: 02 August 2024 Accepted: 10 August 2024 Published: 31 August 2024

Physiological and anthropometric markers play a crucial role in assessing an individual's health and fitness levels. Indicators such as resting heart rate, blood pressure, and maximal oxygen uptake (VO2 max) are important physiological markers of cardiovascular health and aerobic fitness. Lower resting heart rates and blood pressure readings, along with higher VO2 max values, are generally associated with better cardiovascular fitness and reduced risk of cardiovascular diseases (Swift et al., 2018). Measures such as body mass index (BMI), waist-to-hip ratio, and body fat percentage can help assess body composition and identify potential health risks associated with excess body fat or low muscle mass (Bouchard et al., 2011). Simple measurements of height and weight can provide basic information about an individual's overall size and build. These measurements are often used in calculating other indices like BMI (Swift et al., 2018).

Numerous previous studies have highlighted the differences in how men and women respond to aerobic training, particularly in terms of changes in physiological parameters such as blood pressure, heart rate (HR), and body fat percentage. Maruf et al. (2012) concluded that gender moderates the effects of training on diastolic blood pressure (DBP), but it only matters for females regarding systolic blood pressure (SBP). This discovery that training has different effects on men and women agrees with the findings of several other studies (Sydo et al., 2014). According to Sydo et al. (2014), the HR responses to exercise differ between sexes, with men's HR responses following the standard formula (220-age), while women's peak HR had a lower intercept and fell more slowly with age (206-0.88age). In contrast, Hruby et al. (2015) found that a well-designed 12-week endurance-training program reduced resting and submaximal HR in both young and old persons, regardless of gender.

Regarding body fat percentage (%BF), studies by Kolahdouzi et al. (2019) and Bradbury et al. (2017) have observed differences in how men and women respond to different training types and intensities. Kolahdouzi et al. (2019) concluded that both single and multiple exercises were effective in reducing %BF in males, while Bradbury et al. (2017) observed a correlation between body mass index (BMI) and %BF, with the strength of the correlation being higher in females than in males. A study by Min et al. (2019) empirically estimated the differences in %BF for males and females after controlling for BMI. Earlier, Kim et al. (2018) concluded that for the same level of BMI, the %BF of females was 10.4 % higher than that of males, which could explain why they respond differently to different durations and intensities of training when it comes to reducing body fat. Again, when comparing genders, Nystoriak et al. (2018) discovered that women significantly reduced body fat more than men. Williams et al. (2015) found a significant weak to moderate negative linear link between %BF and normalised strength in both sexes, but the relationships were more robust for women. Santanasto et al. (2015) agreed with these findings and suggested that a combination intervention would be most beneficial for women in reducing body fat.

Despite the positive effects of aerobic exercise on health, it has not been very successful in helping individuals begin and maintain a physically active lifestyle. It has been documented that 68 % of the population does not practice the recommended physical exercise (World Health Organization, WHO, 2018). Not meeting the recommended level of physical exercise has been established as a risk factor for non-communicable diseases (WHO, 2021). About 64 % of the population in Africa does not meet the recommended level of physical exercise, while 66 % of deaths in Africa are attributed to non-communicable diseases (WHO, 2021). In Ghana, about 60 % of the population does not meet the recommended level of physical exercise, and of this figure, about 30 % are obese (Ghana Health Service, 2023).

The assessment of physiological and anthropometric markers holds significant implications in light of the global burden of physical inactivity, sedentary lifestyles, and non-communicable diseases (Lee et al., 2021). These markers serve as vital tools for evaluating health and fitness levels, enabling early identification of potential risks and guiding targeted interventions. The prevalence of physical inactivity among adults and adolescents worldwide is alarmingly high, contributing to increased morbidity and mortality rates (WHO, 2018). In recognition of this pressing issue, the WHO has set forth a global action plan aimed at reducing the prevalence of physical inactivity by 15 % among adults and adolescents worldwide by 2026, relative to the baseline in 2018 (WHO, 2018). This ambitious goal underscores the urgency of addressing the physical inactivity epidemic and promoting active lifestyles to combat the rising tide of non-communicable diseases.

This research aligns with the United Nations Sustainable Development Goals (SDGs), SDGs 3 (Good Health and Well-being), and SDG 5 (Gender Equity). This study addresses a critical gap in understanding how aerobic exercise affects health markers differentially across genders, specifically within the urban African context of Accra, Ghana. This focus is particularly relevant given the rising prevalence of non-communicable diseases in sub-Saharan Africa and the potential role of physical activity in mitigating these health risks (WHO, 2018). Moreover, by examining gender-specific responses to exercise, this study contributes to the body of knowledge necessary for developing tailored health interventions. Such gender-sensitive approaches are crucial for achieving SDG 5, emphasising the need for gender equality and empowerment of all women and girls (United Nations, 2015). A literature review did not identify any studies conducted on gender differences in health marker response in Ghana, leaving a research gap that needs to be filled. The aim of this study was to examine gender differences in health marker response to aerobic exercise among Keep Fit clubs in Accra, Ghana.

2. Materials and Methods

Ethical Considerations

Ethical clearance was given by the University Cape Coast Institutional Review Board (UCCIRB) after the necessary documents were presented and assessed by the Board. The approval with reference number UCCIRB/CES/2020/23 was given. Participants were also assured of the confidentiality of their information, and the researcher ensured that the figures were only disclosed to the individual concerned. Numbers were used to identify the individuals and not the names for confidentiality purposes.

Study Design

A pre-test and post-test control group quasi-experimental design was used to find the effect of long-duration aerobic exercise on blood pressure, HR, and percentage of body fat of Keep Fit Club members in Accra. In this design, quasi-experimental control groups were used for the study because random sampling and assignment to the groups could not be done; rather, intact groups were used (Ofori, Dampson, 2011). There were two intact groups at the centre, namely those who participated once a week and those with two or more days of participation in an exercise. Both groups were pre-tested on blood pressure, HR, and percentage of body fat; before the experimental group was exposed to the intervention, a post-test was conducted on both groups to assess the effect of the treatment (Cohen, 2013).

Population

The target population was all regular and active exercise programme participants in the Keep Fit Club in Adentan Municipality. The target population was 108, of which 23 were adolescents under the age of 19 and 85 were adults. The accessible population was expected to be 85 adults, comprising 45 males and 40 females (Gymike Fitness Centre, 2019). Adults were used because the American College of Sports Medicine protocol used in this study was designed for adults.

Sample

A purposive sampling technique was used to select Gymike Keep Fit Club because the fitness centre had participants with unique characteristics of age and fitness level, which suit the purpose of the study. The fitness centre had much patronage from people and was well known. It is also well organised and has written records of the participants, making monitoring easy. Out of the accessible population of 85 participants targeted, a sample of 64 volunteers representing 75 % of the accessible population from the Keep Fit Club participated in this research after the participants were enlightened about the purpose of the study. Those who volunteered were 64 from both groups, who exercised once a week and two or more times a week, hence the sample size. It was not possible to randomly select and assign the participants; thus, the intact groups of exercising once a week and 2 or 3 times a week were used. Fifty per cent (n=32) of the participants in the study were from the intact group who exercise once a week, and the other 50 % (n=32) of the participants were also from the other intact groups who exercise three times a week. The participants comprised 53 % (n=34) males and 47 % (n = 30) females. Each intact group had 17 males and 15 females.

Measures

Physical Activity Readiness Questionnaire (PAR-Q): The PAR-Q was adopted from the “Canadian Society for Exercise Physiology” (2002) and used for pre-exercise screening. The questionnaire has seven questions to screen individuals with known diseases or signs or symptoms of diseases that may be at high risk of adverse effects during physical exercise. A 'yes' response to any of the seven questions on PAR-Q by a participant did not engage in an exercise programme without seeking guidance from a health professional. However, a 'no' response to all seven questions on PAR-Q was given by a participant who participated in the exercise programme without further consulting a health professional. The instrument's reliability was 0.9 by the "Canadian Society for Exercise Physiology" (2002) and was considered high (Benjamin et al., 2018).

Omron Automatic Digital Blood Pressure Monitor: Both systolic and diastolic blood pressure were taken with an automatic BP monitor (Omron Automatic Digital BP Monitor, Hem-7134-E) endorsed by the American Heart Association, model M3 Basic, according to the procedures of the British Hypertension Society (Whelton et al., 2018; Williams et al., 2018).

Stadiometer: Stadiometer readings were taken barefooted and in minimum athletic attire to the closest centimetre (0.1cm) to measure the height of participants. The stadiometer had a reliability coefficient of 0.96, as reported in the user manual (Hruby et al., 2015). Again, the reliability was calculated from the pre-testing of the instrument, which yielded a reliability coefficient of 0.95 and was also compared to the already established co-efficient of 0.96 reported in the user manual. This was also considered high (Benjamin et al., 2018).

Weighing Scale: The weight of the participants was measured with a weighing scale. A scale was placed on a level, hard and uncarpeted floor. The reliability was calculated from the pre-testing of the instrument, which yielded a reliability coefficient of 0.95 and was also compared to the already established co-efficient of 0.96 reported in the user manual. This was considered to be high (Benjamin et al., 2018).

Bioelectrical Impedance: Body fat measurement was computed using a Bioelectrical Impedance, Omron Body Composition Monitor, BF511, made in Japan (William et al., 2018). Before the participants' %BF was measured, the participants' data (gender, weight, height, and age) were taken. The participants were directed one after the other to stand on the weighing scale, and the participants' data (gender, weight, height, and age) were imputed into the Bioelectrical Impedance machine by the researcher. Values were also rated against the WHO (2010) and Netfit (2016) recommendations. The weighing scale's reliability coefficient was 0.96, as reported in the user manual (Katyal et al., 2011; Mwangi, Rintaugu, 2017). The reliability was calculated from the pre-testing of the instrument, which yielded a reliability coefficient of 0.96 and was also compared to the already established co-efficient of 0.96 reported in the user manual. This was considered to be high (Benjamin et al., 2018).

Standard Non-elastic Measuring Tape: The waist and hip circumferences were measured with a standard non-elastic measuring tape (capacity of 150 centimetres) following the guidelines recommended in the Anthropometric Standardisation Reference Manual (Stewart et al., 2011) and according to the procedures described by (Venkateswarlu, 2011). The waist-to-hip ratio between 0.80 – 0.90 were considered safe (Gotlib, 2011). The standard non-elastic measuring tape (capacity of 150 centimetres) has a reliability coefficient of 0.97, as reported by the user manual (Damuesh, 2015). The reliability was calculated from the pre-testing of the instrument, which yielded a reliability coefficient of 0.96 and was also compared to the already established coefficient of 0.97 reported in the user manual. This was considered to be high (Benjamin et al., 2018).

Wristwatch Smart Band: Exercise intensity was measured with a wristwatch smart band version BT 4.0, which is programmable to monitor HR, the number of steps taken, calories burnt, and time. The intensity of aerobic exercise training is usually determined as a range: 20-40 % of HR as light intensity, 40-60 % of HR as moderate intensity, 60-90 % of HR as vigorous intensity, and 91-100 % of HR as maximal intensity (Garber et al., 2011). The instrument had a reliability of 0.94.

Data Collection Procedure

An introductory letter was obtained from the Department of Health, Physical Education and Recreation to the management of the Keep Fit Centre, where permission was granted to conduct the study. The following biodata of participants, including age and gender, was collected. After obtaining informed consent and collecting bio-data, the participants were tested using the following sequence.

– Measurement of blood pressure and HR
– Recording of weight
– Measurement of height
– Analysis of per cent body fat
– Waist circumference

– Hip circumference

These tests were conducted in the morning, preceding the commencement of the aerobic exercise section. The researcher explained the details concerning the 12-week training programme to the participants. Only those who volunteered were screened using PAR-Q for the study. Physiological variables of measurements were taken on two different occasions: before exercise programme T1 (pre-test) and after completing the 12-week aerobic exercise programme T2 (post-test). The procedures for measuring these variables were non-invasive.

The researcher and the research assistants conducted the pre-test and the post-test on the dependent variables, which were recorded according to exercise groups. Two days were used for the pre-test, a day for a particular group; after the pre-test, the researcher described to the participants all activities and procedures involved during the exercise programme for the various groups.

At the end of week 12, all the participants in the different groups were tested (post-test), and the researcher, with the research assistants, conducted the post-test on the participants. The researcher and research assistants in each group administered the tests to the groups. The scores of the measurements were collected on the spot.

The following conditions were observed:

1. The researcher ensured that all measurements were conducted on the same day and time to ensure equal testing conditions for all participants.
2. The purposes of each test item were explained to the participants before the commencement of the test and exercise training programme.
3. The time and place for the commencement of the test range from 6.00 am to 9.00 am or 4.00 pm to 6.30 pm on each test and exercise day because this is the time of the day that is more convenient to exercise, and the temperature was suitable for physical activity.
4. All participants were asked to maintain their current lifestyle, including their normal meals, for a 3-month run-in period followed by pre-exercise testing.
5. All participants were encouraged to wear sports outfits appropriate for the test and training conditions.
6. All participants were assured of confidentiality of their records.

One physical education teacher, a nurse, and a fitness instructor served as research assistants for this research. The researcher adequately explained the purposes of each test item and the protocol involved to the research assistants. This was to guide them in effectively evaluating the different parameters of the participants assigned. In addition, they were involved in recording, taking measurements, and supervising participants during the training sessions.

Table 1. Exercise and Data Collection Time Table

Week	**Exercise Schedule/Data Collection**
1	Baseline Data Collection/ Exercise
2	Exercise
3	Exercise
4	Exercise
5	Exercise
6	Exercise
7	Exercise
8	Exercise
9	Exercise
10	Exercise
11	Exercise
12	Post Data Collection/Exercise

Data Analysis

A paired sample t-test comparison of means was calculated to determine gender differences in the effectiveness of the exercise protocols on the selected anthropometric and physiological measures for both males and females separately.

3. Results

A paired sample t-test comparison of means analysis was performed on each of the selected variables. Figure 1 presents the mean plot of the respondents' average SBP across gender and training schedules.

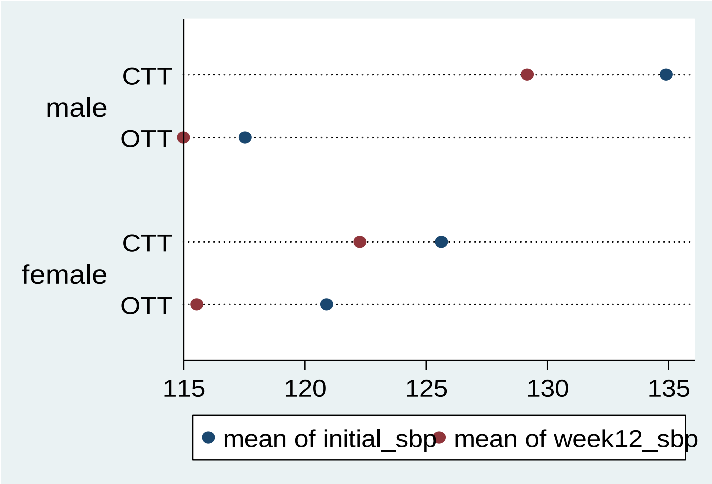

Fig. 1. Effectiveness of Exercise Protocol on SBP among Males and Females

The results revealed that the mean SBP of males in the continuous training (CTT) group was about 134.91 at the onset of the training, which reduced to 129.18 after 12 weeks. The paired sample t-test output suggests that the SBP of the male participants in the CTT group significantly reduced by about 5.73 at the 5 % significance level ($t = 6.79$, $df = 15$, mean (diff) > 0, p-value < 0.001).

Also, the males in the one-time training (OTT) group began the training with an average SBP of about 117.55 and ended with an average SBP of about 115.00. The paired sample t-test indicated that the SBP of the males in the OTT group significantly reduced by about 2.55 at the 5 % significance level ($t = 2.23$, $df = 15$, $p < 0.001$). The average reduction in SBP of males in the CTT group was about twice that of the males in the OTT group, which confirms the observation that CTT training could be more beneficial to males than OTT training when it comes to reducing SBP.

The results in Figure 1 further suggest that the females in the CTT group began with an average SBP of about 125.64 and ended with 122.27 after 12 weeks of training. The paired sample t-test results indicate that females in the CTT group reduced SBP by about 3.36, and the difference was statistically significant at the 5 % significance level ($t = 5.68$, $df = 15$, $p < 0.001$). Also, the females in the OTT group began the training with an average SBP of 120.91 and ended with an average SBP of about 115.54. The mean comparison test suggested an average reduction of about 5.36 ($t = 10.74$, $df = 15$, p-value < 0.001) for females participating in the OTT.

Figure 2 presents the mean plot of the respondents' average DBP across gender and training schedules.

The results indicated that the mean DBP of males in the CTT group was about 85.6364 at the onset of training, which reduced to 81.616 after 12 weeks. The paired sample t-test results suggest that the DBP of the male participants in the CTT group significantly reduced by about 5.727 at the 5 % significance level ($t = 4.000$, $df = 15$, Ha: mean(diff) > 0, p-value < 0.001). Also, males in the OTT group began the training with an average DBP of about 80.9091 and ended with an average DBP of about 78.272. The paired sample t-test indicates that the DBP of the males in the OTT group significantly dropped by about 2.636 ($t = 5.823$, $df = 15$, $p < 0.001$). The average drop in DBP of males in the CTT group was about 1.5 times that of the males in the OTT group, which confirms the observation that CTT training could be more beneficial to males than OTT training when it comes to reducing DBP.

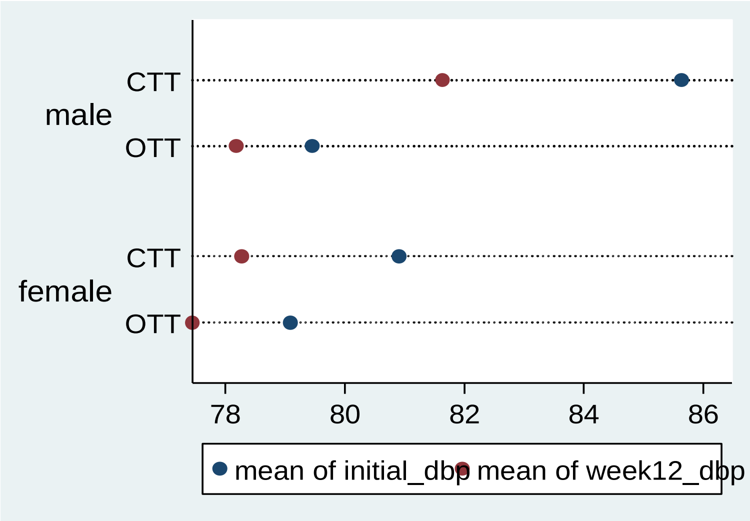

Fig. 2. Effectiveness of Exercise Protocol on DBP among Males and Females

The results in Figure 2 further revealed that the females in the CTT group began with an average DBP of about 79.454 and ended with 78.181 after 12 weeks of training. The paired sample t-test results indicate that females in the CTT group dropped in DBP by about 1.272, and the difference was statistically significant at the 5 % significance level (t = 2.353, df = 15, p = 0.02). Also, the females in the OTT group began the training with an average DBP of about 79.0909 and ended with an average DBP of about 77.454 after the 12 weeks of training. The mean comparison test suggests an average significant drop of about 1.636 (t = 3.008, df = 15, p-value < 0.001) for males participating in the OTT.

Figure 3 presents the mean plot of the respondents' average HR across gender and training schedules.

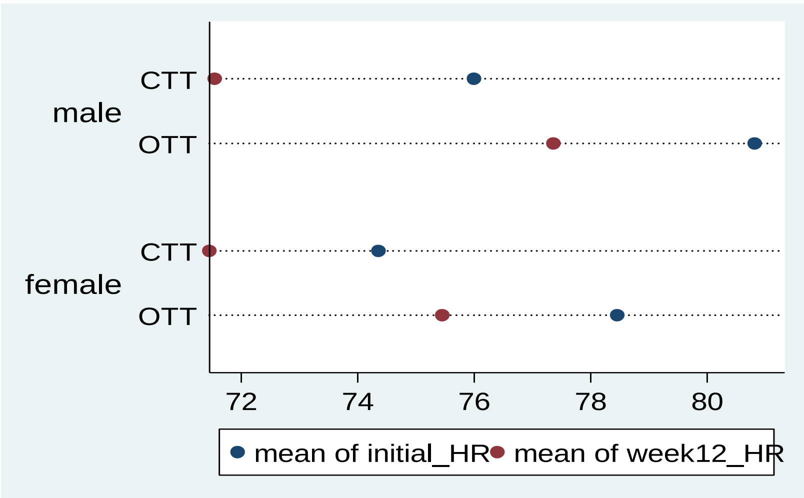

Fig. 3. Effectiveness of Exercise Protocol on HR among Males and Females

The results showed that the mean HR of males in the CTT group was about 76.00 at the beginning of the training, which reduced to 71.55 after 12 weeks. In addition, the paired sample t-test results revealed that the HR of the male participants in the CTT group significantly decreased by 4.45 at the 5 % significance level (t = 6.69, df = 15, Ha: mean (diff) > 0, p-value < 0.001). Also, the males in the OTT group began the training with an average HR of 80.82 and ended with an average HR of 77.36. The paired sample t-test indicates that the HR of the males in the OTT group significantly reduced by 3.45 (t = 6.536, df = 15, p < 0.001). The results of the one-sample t-test suggest that the average reduction in HR of males in the CTT group was significantly higher than that of the males in the OTT group (t = -1.86, df = 15, p < 0.001), which suggests that CTT training is more beneficial to males than OTT training when it comes to reducing the HR.

The results in Figure 3 further revealed that the females in the CTT group began with an average HR of 74.36 and ended with 71.45 after 12 weeks of training. The paired sample t-test results indicate that females in the CTT group reduced HR by about 2.90, and the difference was statistically significant at the 5 % significance level (t = 11.61, df = 15, p < 0.001). Also, the females in the OTT group began the training with an average HR of 78.45 and ended with an average HR of 75.45. The mean comparison test indicated an average significant reduction of 3.00 (t = 1.744, df = 15, p-value < 0.001) for females who participated in the OTT protocol.

Further, the effectiveness of the exercise protocols on the percentage of body fat (BF) reduction among males and females was examined. Figure 4 presents the mean plot of the respondents' average percentage of body fat (%BF) across gender and training schedules.

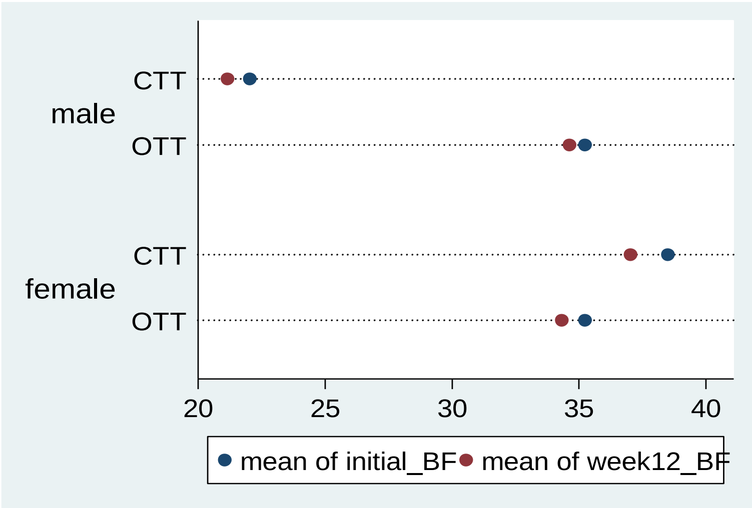

Fig. 4. Effectiveness of the Exercise Protocols on Percent Body Fat (BF) among Males and Females

The results indicated that the mean %BF of males in the CTT group was about 22.04 at the beginning of the training, which reduced to 21.15 after 12 weeks. The paired sample t-test results suggest that the %BF of the male participants in the CTT group significantly reduced by about 0.88 at the 5 % significance level (t = 5.06, df = 15, Ha: mean(diff) > 0, p-value < 0.001). Also, the males in the OTT group began the training with an average %BF of about 35.25 and ended with an average %BF of about 34.64. The paired sample t-test indicated that the %BF of the males in the OTT group significantly dropped by about 0.61 (t = 9.091, df = 15, p < 0.001). The average drop in %BF of males in the CTT group was higher than that of the males in the OTT group.

The results in Figure 4 further revealed that the females in the CTT group began with an average %BF of about 38.51 and ended with 37.04 after 12 weeks of training. The paired sample t-test results indicated that females' %BF in the CTT group dropped by 1.47, and the difference was statistically significant at the 5 % significance level (t = 10.050, df = 15, p < 0.001). Also, the females in the OTT group began the training with an average %BF of 35.24 and ended with an average %BF of about 34.34. The mean comparison test suggested an average significant reduction of about 0.90 (t = 1.744, df = 15, p-value < 0.001) for females participating in the OTT.

4. Discussion

The results indicate that the CTT training leads to a significantly broader drop in DBP for females and males. The results support the findings of Maruf et al. (2012), who concluded that differences exist in the effects of training on DBP, but it only matters to females regarding SBP. A similar explanation could be that the endurance of males for the multiple training exercises could be considered to be higher than that of the females; hence, females may find the OTT an easier option than the multiple exercise plan (Evetovich, Eckerson, 2018). The results indicate that the CTT training leads to a significantly greater percentage reduction in HR for males than females. In comparison, the OTT training schedule leads to a greater percentage reduction in HR for females than males when all other factors are constant. The results suggest that training type has an effect on HR for males and females.

This discovery that training has different effects on men and women agrees with those of several previous studies (Sydo et al., 2014). According to Sydo et al. (2014), the HR responses to exercise differ between sexes. Using the standard formula (220-age), Sedo et al. found that men's HR responses were similar to those obtained, but women's peak HR had a lower intercept and fell more slowly with age (206-0.88 age). Therefore, men and women of the same age can have differing HR response rates to the same type of exercise, even if all other parameters are constant. In contrast, Hruby et al. (2015) found that a well-designed 12-week endurance training programme reduced resting and submaximal HR in both young and old persons.

The results indicate that the CTT training leads to a greater percentage reduction in %BF for both males and females. In comparison, the OTT training schedule leads to a lower percentage reduction for females than males when all other factors are constant. The observation that both types of training were significantly effective for males was consistent with the studies of Kolahdouzi et al. (2019), who reached a similar conclusion after comparing single and multiple exercises. Females were found to benefit less from a single exercise per week compared to three times per week, which implies they have different responses to training types when it comes to reducing the percentage of body fat. Bradbury et al. (2017) observed the correlation between the BMI of males and females, which could explain the differences observed in the current study about the gender effects of training exercises. Bradbury et al. indicated that though strong positive correlations exist between the percentage of body fat and BMI among males and females, the strength is more muscular among females than among males. They concluded that among males and females of identical BMI, females are more likely to have a higher percentage of body fat than males, which explains why some training exercises that could work for males may not work for females.

A study by Min et al. (2019) empirically estimated the differences in the percentage of body fats for males and females after controlling for BMI. Earlier, Kim et al. (2018) concluded that for the same level of BMI, the percentage of body fat of females was 10.4 % higher than that of males, which could make them respond differently to different durations and intensities of training when it comes to reducing body fat. When comparing genders, Nystoriak et al. (2018) discovered that women significantly reduced body fat. There was a significant weak to moderate negative linear link between the percentage of body fat and normalised strength in both sexes, as shown by Williams et al. (2015). Women, however, had more robust relationships. Santanasto et al. (2015) agreed with these findings and suggested that combination intervention would be most beneficial to women.

5. Strengths and Limitations

The study captured how aerobic exercise affects health markers in the complex, multifaceted reality of people's lives in Accra rather than in an artificial, controlled environment. The results are more likely to apply to other real-world urban African contexts where people's lives are similarly complex and varied. It provides information on the effectiveness of community-based fitness programmes (Keep Fit Clubs) in improving health outcomes despite the variability in participants' lifestyles.

Physiological and anthropometric health markers of an individual are not determined by exercise alone. The researcher had no control over their diet since they all lived in various homes and planned their menu. Diet affects some physiological variables, and that may have affected the results. Apart from diet, other factors such as where participants live, their occupation, or physical activity level, which could affect the results, were not considered in the research. The result may be affected by the variables mentioned above and their influence on human health. The groups were intact or in place before the study; therefore, the base variables were not identical from the beginning of this study. These limitations of diet, occupation and physical activity will affect the generalizability of the finding beyond the sample. The study mainly focused on evaluating treatment responses within each gender but did not directly compare the responses between males and females. This limits our ability to determine whether the observed differences are statistically significant across genders.

6. Implications of the Study

Theoretically, the study contributes to the understanding of the effects of different exercise protocols (continuous training vs. one-time training) on various anthropometric and physiological measures. It provides insights into the effectiveness of these exercise protocols in reducing systolic blood pressure, diastolic blood pressure, heart rate, and body fat percentage across genders.

Practically, the findings suggest that CTT may be more beneficial than one-time training OTT for males in reducing systolic blood pressure, diastolic blood pressure, heart rate, and body fat percentage. For females, both CTT and OTT protocols were effective in reducing the measured variables, but the relative effectiveness varied depending on the specific measure. These insights can inform the development of tailored exercise programmes and recommendations based on gender and desired health outcomes.

7. Conclusion

Based on the results presented, the following conclusions are drawn: CTT was more effective than one-time training OTT for reducing SBP, DBP, HR, and %BF in both males and females. Gender differences exist in the effects of the training protocols on the measured variables. For SBP and DBP reduction, CTT was more beneficial for males than females, while OTT was more effective for females than males. For HR reduction, CTT led to a significantly greater percentage reduction in males than females, while OTT led to a greater percentage reduction in females than males. For %BF reduction, CTT led to a greater percentage reduction for both males and females, but OTT was more effective for males than females. The differences in the responses of males and females to the training protocols are attributed to factors such as differences in endurance levels, heart rate responses to exercise, the relationship between body fat percentage and BMI, and the potential influence of hormonal factors. The results suggest that to optimise the effectiveness of exercise protocols, gender should be considered as a moderating factor, and exercise programs may need to be tailored differently for males and females to achieve desired outcomes in variables like blood pressure, heart rate, and body fat reduction. In summary, the study highlights the importance of considering gender differences when designing and implementing exercise protocols, as males and females may respond differently to different training schedules and intensities, particularly for variables related to cardiovascular health and body composition.

8. Declarations

Ethics approval and consent to participate

The UCCIRB granted ethical approval for the study (UCCIRB/CES/2020/23).

Consent for publication

All authors read and approved the final version of the manuscript for publication and agree to be accountable for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Availability of data and materials

The data supporting this study will be made available upon reasonable request to the corresponding author (daniel.apaak@ucc.edu.gh).

Conflict of interest statement

The authors do not have any personal or financial interest in this study.

Funding

The study received no funding

Authors' contributions

NA and DA conceptualised the study. NA and DA designed the study with input from NA, DA, and CA, and analysed and interpreted the data. CA drafted the initial manuscript. NA, DA and CA contributed to the revision and finalisation of the manuscript. All authors read and approved the final version of the manuscript.

Acknowledgements

The authors thank the manager and members of the Gymike Keep Fit Club for permitting and assisting us in conducting the study.

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