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Evaluating Health Markers Response to Aerobic Exercise among Keep Fit Club Members in Ghana: A Paired Analysis Across Age Categories

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Abstract

This study examined the effects of Continuous Training Technique (CTT) and One Time Training (OTT) on systolic blood pressure (SBP), diastolic blood pressure (DBP), heart rate (HR), and body fat percentage (%BF) among youth (20 - 30 years) and adults (31 - 40 years) in a Ghanaian keep-fit club. The 12-week quasi-experimental study included 64 participants divided into CTT (3 times/week) and OTT (once/week) groups. Pre- and post-intervention measurements were analyzed using paired t-tests. Both protocols significantly reduced all health markers in youth and adults, with varying effectiveness. CTT led to greater reductions in DBP and %BF for both age groups. OTT was more effective in reducing SBP for youth, while CTT had a greater impact on adults. HR reductions were similar between protocols for youth, but CTT was more effective for adults. The study concludes that while both CTT and OTT provide health benefits, their effectiveness depends on age and the physiological parameter targeted. These findings support tailoring exercise prescriptions to optimize health outcomes for different age groups. Future research should explore the long-term sustainability of these improvements and underlying age-related differences in response to exercise.

Keywords

Adult, Aerobic Exercise, Continuous Training Exercise, Health Markers, One-Time Training

1. Introduction

Regular physical activity has been well-documented as a fundamental contributor to health and well-being, with aerobic exercise being particularly effective in improving cardiovascular health and other key health markers (Cornelissen & Smart, 2013; Clark, 2015). The benefits of aerobic exercise include reduced blood pressure, improved lipid profiles, and enhanced overall physical function, which is especially crucial for mitigating the effects of aging (Woo, Derleth, Stratton, & Levy, 2006; Atikumi, Apaak, & Akubah, 2024).

In recent years, considerable research has been conducted to understand the effects of various training programmes on blood pressure and other health parameters across different age groups. It has been observed that training typically helps reduce systolic blood pressure (SBP) in both youth and adults, although the magnitude of the effects may vary between these groups (Atikumi, 2023; Stevens, Katz, & Huxley, 2010). Studies have indicated that both mild and moderate-intensity training programmes are effective in reducing blood pressure in adults (Cornelissen & Smart, 2013), while short-interval training, commonly referred to as continuous training technique (CTT), has also been found to significantly impact blood pressure, lipid profile, and physical function during aging (Clark, 2015).

Moreover, Woo, Derleth, Stratton, and Levy (2006) reported that young participants tend to benefit more from multiple training exercises per week compared to older adults. This is consistent with Atikumi et al. (2024), who concluded that multiple training sessions have additional positive effects on arterial stiffness in hypertensive older adults. On the other hand, Paoli et al. (2017) highlighted that age plays a crucial role in the effectiveness of training on diastolic blood pressure (DBP) in adults, suggesting that training interventions may need to be tailored according to age for maximum benefits.

Heart rate (HR) is another crucial indicator of cardiovascular health, and the type of training may significantly influence HR reduction across different age groups. According to Cornelissen and Smart (2013) and Clark (2015), young men and women who engaged in multiple or CTT training showed substantial reductions in Woo et al. (2006) further explained that older age is associated with decreased exercise efficiency and increased oxygen cost of exercise, necessitating more frequent or continuous exercises to achieve similar reductions in HR compared to younger individuals. The formula for estimating maximum HR, "220-age" (Sydó, 2014), also implies that older individuals require greater effort to achieve the same training outcomes as younger people.

In terms of body composition, Sykes, Choo, and Cotterrell (2004), along with Kim, Ko, Seo, and Kim (2018), found that single-time training was effective for younger individuals in reducing body fat percentage (%BF), whereas older adults may derive greater benefits from a more frequent training approach. Taken together, these studies emphasise the importance of considering age when designing training programmes to achieve optimal health outcomes across different populations.

Keep fit clubs, which are social groups dedicated to promoting regular physical activity, have become popular avenues for fostering community health, particularly in sub-Saharan Africa. Though a study was conducted to examine the differential impact of exercise interventions on health markers across genders (Atikumi et al., 2024), limited research has examined the differential impact of exercise interventions on health markers across various age categories within such community settings. This study aims to evaluate the responses of selected health markers—including systolic and diastolic blood pressure (SBP and DBP), heart rate (HR), and body fat percentage (%BF)—to aerobic exercise among keep fit club members in Ghana. We hypothesise that there will be no age difference in the effects of the aerobic exercise programme on selected health markers of keep fit club members.

This research aligns with the United Nations Sustainable Development Goals (SDG) 3 (Good Health and Well-being). The significance of this study lies in its contribution to understanding the effects of aerobic exercise on key health markers such as blood pressure, heart rate, and body fat percentage among Keep Fit Club members in Ghana, with a particular emphasis on age-related variations. By addressing the research gap on age-specific exercise benefits in community settings in sub-Saharan Africa, the findings will guide the development of tailored exercise programmes to optimise health outcomes. This, in turn, will contribute to more effective public health initiatives. Furthermore, the use of a paired analysis approach provides strong evidence of individual health improvements, thereby supporting the promotion of aerobic exercise in community health programmes.

2. Methods

2.1. Participants

The study exclusively involved healthy individuals, determined through a pre-screening process to ensure their eligibility. The pre-exercise screening was conducted using the "Physical Activity Readiness Questionnaire (PAR-Q)" developed by the Canadian Society for Exercise Physiology in 2002. This questionnaire comprises seven items designed to identify individuals with known diseases or symptoms indicative of conditions that could increase the risk of adverse effects during physical activity. Participants who answered "yes" to any of the questions were advised to consult a healthcare professional before participating in the exercise program. Conversely, those who responded "no" to all the questions proceeded with the program without additional medical consultation. The reliability of the PAR-Q instrument was reported by the Canadian Society for Exercise Physiology in 2002 as 0.9, a level deemed sufficiently high for this study (Wallen & Fraenkel, 2013).

A purposive sampling approach was adopted to select Gymike Keep Fit Club as the study site. This fitness center was chosen because its participants exhibited specific age and fitness characteristics that aligned with the study's goals. The center's reputation, organization, and detailed participant records further facilitated monitoring and data collection.

Out of an accessible population of 85 participants, 64 volunteers (75% of the population) were recruited after being briefed on the study's purpose. Recruitment was conducted through the fitness center, targeting individuals who were already exercising either once a week or two to three times per week. Participants from these two exercise frequency groups were invited to volunteer, resulting in a sample size of 64 individuals.

Since random selection and assignment were not possible, the study relied on these intact groups of participants based on their existing exercise frequency. The inclusion of both groups allowed for a comprehensive assessment of the impact of aerobic exercise on the selected physiological variables.

2.2. Instruments

2.2.1. Physical Activity Readiness Questionnaire (PAR-Q)

The Physical Activity Readiness Questionnaire (PAR-Q), developed by the Canadian Society for Exercise Physiology in (2002), was utilized for pre-exercise screening. This seven-item questionnaire identifies individuals with existing diseases or symptoms that may predispose them to adverse effects during physical activity. Participants who responded "yes" to any of the seven questions were required to seek medical guidance before engaging in the exercise program, whereas those who answered "no" to all questions were permitted to participate without additional medical consultation. The instrument demonstrated a reliability coefficient of 0.9, as reported by the Canadian Society for Exercise Physiology (2002), and was confirmed to be high (Benjamin et al., 2018).

2.2.2. Omron Automatic Digital Blood Pressure Monitor

Blood pressure, both systolic and diastolic, was measured using the Omron Automatic Digital Blood Pressure Monitor (Model Hem 7134-E, endorsed by the American Heart Association). The procedures adhered to the guidelines of the British Hypertension Society (Whelton et al., 2018; Williams et al., 2018).

2.2.3. Stadiometer

Participants' height was measured using a stadiometer, recorded barefoot and in minimal athletic attire to the nearest 0.1 cm. The stadiometer had a reported reliability coefficient of 0.96 (Hruby & Hu, 2015). Pre-testing of the instrument yielded a reliability coefficient of 0.95, closely aligning with the manufacturer-reported reliability of 0.96, indicating high reliability (Benjamin et al., 2018).

2.2.4. Weighing Scale

Body weight was measured using a calibrated weighing scale placed on a flat, hard, uncarpeted surface. Pre-testing confirmed a reliability coefficient of 0.95, consistent with the manufacturer-reported reliability of 0.96, both deemed high (Benjamin et al., 2018).

2.2.5. Bioelectrical Impedance

Body fat percentage was measured using the Omron Body Composition Monitor (Model BF511). Before measurements, participants' gender, weight, height, and age were entered into the device. Each participant then stood on the monitor for data collection. Results were compared against recommendations from the World Health Organization (2010) and Netfit (2016). The instrument demonstrated a reliability coefficient of 0.96, confirmed by pre-testing, and was consistent with the manufacturer's specifications (Katyal et al., 2003; Mwangi et al., 2017).

2.2.6. Standard Non-Elastic Measuring Tape

Waist and hip circumferences were assessed using a non-elastic measuring tape (150 cm capacity), following the guidelines of the *Anthropometric Standardisation Reference Manual* (Stewart et al., 2017) and additional protocols (Venkateswarlu et al., 2011). A waist-to-hip ratio of 0.80 - 0.90 was considered safe (Hara, 2020). The tape's reliability coefficient was reported as 0.97 by the manufacturer (Damuesh, 2015). Pre-testing yielded a similar coefficient of 0.96, further affirming its high reliability (Benjamin et al., 2018).

2.2.7. Wristwatch Smart Band

Exercise intensity was monitored using a wristwatch smartband (BT 4.0 version). This device tracked heart rate (HR), step count, calories burned, and duration of activity. Aerobic exercise intensity was categorized as light (20% - 40% HR), moderate (40% - 60% HR), vigorous (60% - 90% HR), and maximal (91% - 100% HR) based on established guidelines (Garber et al., 2011). The device exhibited a reliability coefficient of 0.94.

2.3. Data Collection Procedure

All participants were briefed on the study's purpose and provided written informed consent. Ethical approval for the research was obtained from an Institutional Review Board (IRB) following a review of the necessary documentation. Confidentiality was prioritized; participants' data were anonymized using identification numbers rather than names, and results were disclosed only to the individual participants.

After securing informed consent and collecting demographic data, participants underwent a series of preliminary assessments in the following order:

1) Blood pressure and heart rate measurements
2) Weight recording
3) Height measurement
4) Body fat percentage analysis
5) Waist circumference measurement
6) Hip circumference measurement

These assessments were conducted in the morning prior to the commencement of the aerobic exercise sessions. Participants were also provided with detailed information about the 12-week training program. Only volunteers who passed the PAR-Q screening participated in the study.

To ensure comparability between the CTT and OTT groups, baseline measurements of SBP, DBP, HR, and %BF were statistically analysed. A Kolmogorov-

Smirnov test was performed to verify the normality of baseline data distributions, and independent t-tests were conducted to compare mean values between the two groups. The results of these analyses indicated that the baseline characteristics were statistically similar across groups ($p > 0.05$ for all variables), ensuring that any observed differences post-intervention were attributable to the exercise protocols rather than pre-existing disparities.

Physiological measurements were collected at two points: pre-test (T1) before the exercise program and post-test (T2) following the completion of the 12-week program. All measurement procedures were non-invasive.

The researcher and research assistants conducted both pre- and post-tests for all dependent variables, with data collection organized by exercise group. The pre-test spanned two days, with each group assessed on a separate day. Following the pre-test, participants were thoroughly briefed on the activities and procedures of the exercise program.

At the conclusion of the 12-week period, post-tests were administered by the researcher and assistants. All measurements were taken under consistent conditions to ensure accuracy. Key procedural considerations included:

1) Conducting all measurements at the same time of day to maintain uniform testing conditions.

2) Explaining the purpose of each test to participants before commencement.

3) Scheduling testing and exercise sessions between 6:00 - 9:00 a.m. or 4:00 - 6:30 p.m. to align with optimal exercise conditions.

4) Advising participants to maintain their usual lifestyle, including dietary habits, during the three-month study period.

5) Recommending appropriate sports attire for tests and training sessions.

6) Guaranteeing the confidentiality of participants' records.

A physical education teacher, a nurse, and a fitness instructor assisted the researcher throughout the study. They were thoroughly trained in the test protocols, data recording, and participant supervision. The study included 64 participants, equally distributed across two exercise groups: one group exercised once weekly, and the other exercised three times weekly. The participants were 53% male (n = 34) and 47% female (n = 30), with each group consisting of 17 males and 15 females. The sample was evenly divided between adults aged 31 - 40 years and youth aged 20 - 30 years.

The schedule for exercise sessions and data collection is presented in **Table 1**.

Table 1. Exercise and data collection schedule.

Week	Activity
1	Baseline data collection and exercise
2 - 11	Exercise
12	Post-data collection and exercise

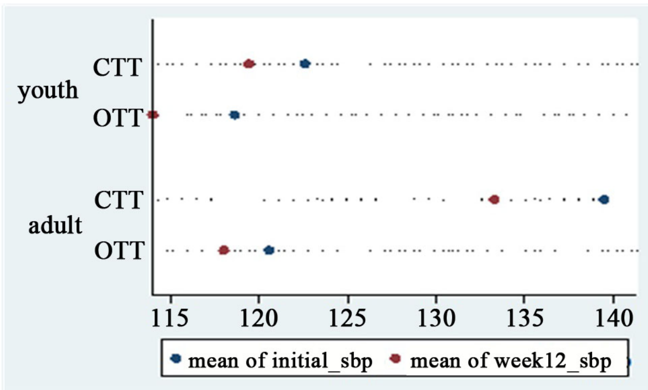
This structured approach ensured the integrity of the study's methodology and the reliability of the collected data.

2.4. Data Analysis

A quantitative data analysis software package (i.e., SPSS 25.0 for Windows) was used to analyse the data. Frequencies and percentages were calculated to identify missing, and a Kolmogorov-Smirnov test was conducted to test for normality. After the data met these assumptions, a paired sample t-test comparison of means was calculated to determine age differences in the effectiveness of the exercise protocols on the selected anthropometric and physiological measures for youth and adult categories separately.

3. Results

A paired sample t-test comparison of means was calculated to determine differences among adults and youth in the effectiveness of the exercise protocols on SBP for youth and adult age categories separately. Figure 1 presents the mean plot of the respondents' average SBP across age categories and training schedules.

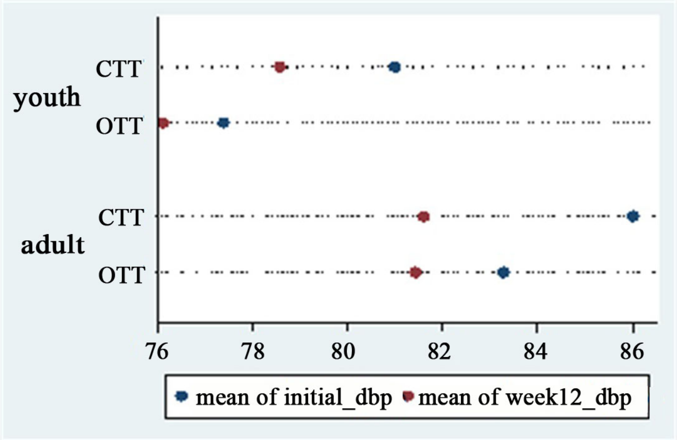


Source: Field data, 2021.

Figure 1. Effectiveness of exercise protocol on SBP among youth and adult.

The results indicated that the mean SBP of the youths in the CTT group was 134.91 at the beginning of the training, which reduced to 119.42 after 12 weeks. The paired sample t-test results suggest that the SBP of the adult participants in the CTT group significantly reduced by 3.17 at the 5% significance level ($t = 5.64$, $df = 15$, p-value < 0.001). Also, the youth in the OTT group began the training with an average SBP of 118.60 and ended with an average SBP of 114.00. The paired sample t-test indicated that the SBP of the adults in the OTT group significantly reduced by 4.60 at the 5% significance level ($t = 2.55$, $df = 15$, $p < 0.001$). The average reduction in the SBP of the youths in the OTT group was 1.43 more than the youths in the CTT group, which confirms the observation that OTT training could be more beneficial to youths than OT training when it comes to reducing SBP.

The results in Figure 1 further revealed that the adults in the CTT group began with an average SBP of about 139.50 and ended with about 133.30 after 12 weeks of training. The paired sample t-test results indicate that the SBP of the adults in the CTT group was reduced by 6.20, and the difference was statistically significant at the 5% significance level (t = 7.89, df = 15, $p < 0.001$). Also, the adults in the OTT group began the training with an average SBP of 120.57 and ended with an average SBP of about 118.00. The mean comparison test suggested an average reduction of 2.57, but the difference was insignificant (t = 1.39, df = 15, p-value < 0.001) for adults who participated in the OTT. Figure 2 presents the mean plot of the respondents' average DBP across age categories (youth against adults) and training schedules.



Source: Field data, 2021.

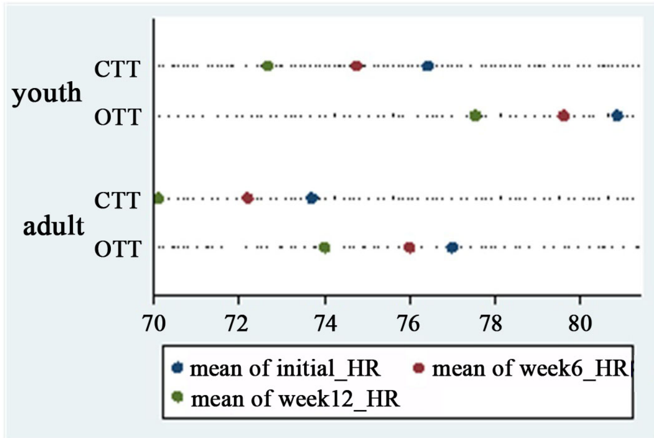
Figure 2. Effectiveness of exercise protocol on DBP among youth and adult.

The results showed that the mean DBP of the youth in the CTT group was 81.000 at the beginning of the training, which reduced to 78.5833 after 12 weeks. The paired sample t-test results suggest that the SBP of the youth participants in the CTT group was significantly reduced by 2.416 at the 5% significance level (t = 5.636, df = 31, p-value < 0.001). Also, the youth in the OTT group began the training with an average DBP of 77.400 and ended with an average DBP of 76.133 after 12 weeks of training. The paired sample t-test indicated that the DBP of the males in the OTT group significantly dropped by 1.2667 at the ten percent significance level (t = 2.522, df = 31, $p < 0.001$). The average drop in DBP of youth in the CTT group was twice that of the youths in the OTT group, which confirms the observation that CTT training could be more beneficial to youths than OTT training when it comes to reducing DBP.

The results in Figure 2 further suggest that the adults in the CTT group began with an average DBP of about 86.000 and ended with about 81.600 after 12 weeks of training. The paired sample t-test results indicate that adults in the CTT group dropped in DBP by about 4.4000, and the difference was statistically significant at the 5% significance level (t = 6.127, df = 31, $p < 0.001$). Also, the adults in the OTT group began the training with an average DBP of 83.285 and ended with an average DBP of 81.428 after 12 weeks of training. The mean comparison test suggested an average statistically significant drop of 1.857 for adults who participated in the

OTT.

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



Source: Field data, 2021.

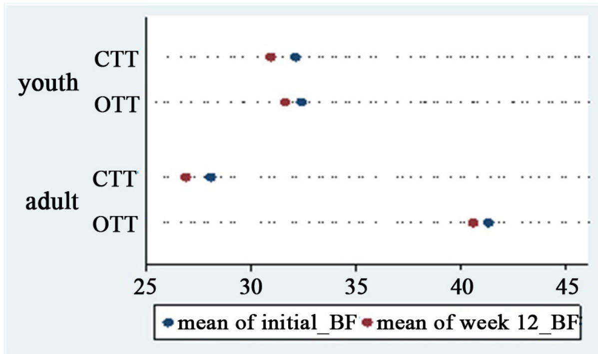
Figure 3. Effectiveness of exercise protocol on HR among youth and adult.

The results revealed that the mean HR of youth in the CTT group was 76.42 at the beginning of the training, which reduced to 72.67 after 12 weeks. The paired sample t-test results suggest that the HR of the youth participants in the CTT group was significantly reduced by 3.75 at the 5% significance level (t = 5.46, df = 15, p-value < 0.001). Also, the youth in the OTT group began training with an average HR of 80.87 and ended with an average HR of 77.53. The paired sample t-test indicated that the HR of the males in the OTT group significantly reduced by 3.34 at the 5% significance level (t = 7.02, df = 9, $p < 0.001$). Therefore, the average reduction in HR of youth in the CTT group was 0.42 more than that of the youths in the OTT group, which makes both approaches relatively good for youth. That is, the one-sample t-test results indicated that the mean HR drop of 3.75 for youth in the CTT group was not statistically significantly different from that of the youth in the OTT group at the 5% significance level (t = −0.606, df = 14, $p > 0.001$).

The results in Figure 3 further indicated that the adults in the CTT group began with an average of 73.70 and ended with 70.10 after 12 weeks of exercise. The paired sample t-test results indicated that the adults in the CTT group reduced HR by 3.6, and the difference was statistically significant at the 5% significance level (t = 13.500, df = 9, $p < 0.001$). Also, the adults in the OTT group began the training with an average HR of 77.00 and ended with an average HR of 74. The mean comparison test suggested an average reduction of 3.00, and the difference was statistically significant (t = 7.94, df = 9, $p = 0.001$) for adults who participated in the OTT. That is, the one-sample t-test results indicated that the mean HR drop of 3.60 of youth in the CTT group was statistically significantly higher than that of the youth in the OTT group (3.00) at the 5% significance level (t = −0.606, df =

14, $p < 0.001$).

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



Source: Field data, 2021.

Figure 4. Effectiveness of exercise protocol on %BF among youth and adult.

The results indicated that the mean %BF of youth in the CTT group was about 32.11 at the beginning of the training, which reduced to 30.94 after 12 weeks. The paired sample t-test results suggest that the %BF of the youth participants in the CTT group significantly decreased by about 1.17 at the 5% significance level (t = 7.39, df = 15, p-value < 0.001). Also, the youth in the OTT group began training with an average %BF of 32.40 and ended with an average %BF of 31.63. The paired sample t-test indicated that the %BF of the youth in the OTT group significantly dropped by 0.77 at the 5% significance level (t = 9.091, df = 14, $p < 0.001$). The average drop in %BF of youth in the CTT group was 0.40 more than that of the youths in the OTT group, which makes both approaches relatively good for youth.

The results in **Figure 4** further revealed that the adults in the CTT group began with an average %BF of 28.07 and ended with 26.88 after 12 weeks of training. The paired sample t-test results indicated that adults in the CTT group dropped in %BF by 1.19, and the difference was statistically significant at the 5% significance level (t = 5.425, df = 14, $p < 0.001$). Also, the adults in the OTT group began training with an average %BF of 41.33 and ended with an average %BF of 4.60. The mean comparison test suggested an average drop of about 0.73, which was statistically significant at the 5% significance level (t = 6.46, df = 14, p-value < 0.001) for adults who participated in the OTT.

4. Discussions

Generally, the result was that training benefits youth and adults, but has different effects on the two groups. The observation that training typically helps reduce the SBP of youth and adults is consistent with the results of Atikumi (2023) and Stevens, Katz, and Huxley (2010). The type of training and age group results indicated that the CTT training leads to a significantly greater percentage reduction in SBP for youths than adults. In comparison, the OTT training schedule leads to a greater percentage reduction for adults than youth when all other factors are constant. The result implies that, within 12 weeks or more, individuals must consider their age group before choosing a training plan that will give them the greatest success in reducing SBP. CTT training involves multiple training exercises within the week, with three different training exercises in a week but with a shorter duration. This implies that the participants must recover from previous training and training within two days intervals continuously for 12 weeks.

This obviously shall be easier for the youth than the adults, keeping other factors constant; hence, the youth will benefit more from this training exercise than the adults. That is, the multiple or CTT arrangement on its own may constitute a stressful situation for the adults who may be tired from the previous training before the demand to attend the next exercise; even if they show up, they may not be fully involved as they did in the previous exercise. However, the adults may have fully recovered from the stress of previous training if training is organised weekly, and hence participate fully. Therefore, though the detraining period reduces the effectiveness of the OTT compared to the multiple CTT, the adults may find it an easy exercise and, hence, benefit more than the youth or other adults in the multiple exercises.

The result on the relationship between age group and training type or plan supports the outcome of earlier studies. For example, Atikumi (2023) indicated that SBP dropped in the single-exercise group for female adults. The results, however, contradicted the finding of Cornelissen and Smart (2013) that both the mild and moderate intensity programmes were influential in blood pressure reduction for adults. Clark (2015) also suggested that short-interval training (multiple or CTT) instead of OTT (single training) was statistically significant in reducing blood pressure, lipid profile, and physical function during aging, but the current study reached the opposite conclusion.

Based on the results that CTT was effective for youth and males in reducing blood pressure, one would expect youth and males to endure more than females and adults. Woo, Derleth, Stratton, and Levy (2006) observed that young participants, irrespective of sex, benefit more from multiple training exercises three times a week by about 2% - 7%. The current study observed a 5% reduction in young participants, which is within their hypothesised range. Atikumi et al. (2024) also concluded that though both multiple and OTT are beneficial to older participants' blood pressure, the former training had an additional positive impact on reduced arterial stiffness in treated hypertensive subjects.

The results indicate that the CTT training leads to a significantly wider drop in DBP for youths and adults when all other factors are constant. The analysis of gender and age suggests that both variables significantly moderate the relationship between training type and its effects on DBP. The results on the age group are consistent with the studies of Paoli et al. (2017) on adults, which observed that age matters in the effectiveness of training on DBP.

The results indicate that CTT training leads to a significantly greater percentage reduction in HR for youths than adults. In contrast, the OTT training schedule leads to a more significant percentage drop for adults than for the youth when all other factors are constant. This observation is consistent with the earlier results of Cornelissen and Smart (2013) and Clark (2015), who observed that young men and women who engage in multiple or CTT reduce HR by an average of 8% and 6%, respectively.

It is evident from the results that the youth could achieve the desired HR reduction from either the CTT or OTT training exercise, but the CTT exercise was more effective at reducing the HR of adults than the OTT exercise. The results indicate that the type of training schedule does not matter in reducing HR for youth, supporting the findings of Cornelissen and Smart (2013). Woo et al. (2006) explained why training type might matter for older people when it comes to reducing HR. Woo et al. found that older age is associated with decreased exercise efficiency and an increase in the oxygen cost of exercise, which contributes to a reduced exercise capacity. Hence, older people may require continuous or multiple exercises to reduce HR compared to younger people.

Theoretically, the fact that age explains the effects of exercise on HR was an a priori expectation based on the formulae for determining the maximum HR of an individual. The HR is a negative linear function of age estimated as "220-age" (Sydó, 2014), implying that the maximum HR decreases with time. Hence, more effort might be needed at an older age than a younger age, which explains the different effects of the different training exercises on the youth and the adults.

The results indicate that the CTT training leads to a greater percentage reduction in %BF for adults. In comparison, the OTT training schedule leads to a lower percentage reduction in %BF for the youth when all other factors are constant. The finding that single-time training was effective for younger trainers supports the earlier findings of Sykes, Choo, and Cotterrell (2004) and Kim, Ko, Seo, and Kim (2018).

5. Conclusion

This study investigated the effectiveness of CTT and Overload Training Time OTT protocols on various physiological parameters across youth and adult populations. The results reveal the nuanced effects of these training protocols on SBP, DBP, HR, and %BF.

For SBP, both protocols demonstrated significant reductions in youth participants, with OTT showing a slightly greater effect. CTT yielded significant SBP reductions in adults, while OTT's impact was less pronounced. Regarding DBP, CTT proved more effective for youth and adults, with more substantial reductions observed than OTT. Heart rate reductions were significant and comparable between CTT and OTT for youth participants. While both protocols led to significant HR reductions in adults, CTT demonstrated a statistically greater effect. Body fat percentage decreased significantly under both protocols for both age groups, with CTT showing marginally better results.

These findings suggest that the effectiveness of exercise protocols varies based on the specific physiological parameter and the age group in question. While both CTT and OTT offer benefits, CTT appears to provide more consistent improvements across the measured variables and age groups.

Future research should explore the long-term sustainability of these physiological improvements and investigate potential mechanisms underlying the age-related differences in response to these exercise protocols. Additionally, studies examining the psychological and quality of life impacts of CTT and OTT could provide a more comprehensive understanding of their overall health benefits.

6. Practical Implications

The results of this study have several practical implications for exercise prescription and public health initiatives:

1) Tailored Exercise Programmes: Fitness professionals and healthcare providers should consider age when designing exercise programs. CTT may be more universally beneficial, while OTT could be particularly effective for managing SBP in youth.

2) Hypertension Management: Given the significant reductions in blood pressure, especially with CTT, these protocols could be incorporated into non-pharmacological interventions for hypertension management, particularly in adult populations.

3) Cardiovascular Health Promotion: Both protocols promise to improve cardiovascular health markers (SBP, DBP, HR). Public health campaigns could promote these structured exercise approaches for general population health improvement.

7. Limitations

While this study provides valuable insights into the effects of aerobic exercise on health markers among keep-fit club members in Ghana, several limitations should be considered. First, the sample size was relatively small, consisting of 64 participants drawn from a single keep-fit club. This limits the gender-based analysis and generalisability of the findings to broader populations or other regional contexts. Additionally, the study employed a quasi-experimental design, relying on pre-existing exercise groups rather than randomising participants. This approach may have introduced selection bias, potentially affecting the internal validity of the results.

Furthermore, participants' adherence to the prescribed exercise protocols and their dietary habits were self-reported, introducing the potential for recall bias or inaccuracies in reporting. Another limitation lies in the scope of the variables studied.

Environmental factors, such as climate, equipment availability, and consistency in exercise supervision, were not controlled, which may have influenced participants' performance and outcomes. The broad categorization of participants into youth (20 - 30 years) and adults (31 - 40 years) may also have overlooked potential intra-group differences in physiological responses to the exercise protocols. While the sample included both male and female participants, the study did not explicitly analyze gender-based differences in response to the training interventions, leaving a critical dimension unexplored.

Future research should address these limitations by employing larger and more diverse samples, implementing randomised controlled designs, extending the duration of the intervention, and incorporating a broader range of health outcomes. Additionally, controlling for external factors and conducting detailed subgroup analyses, including gender-based comparisons, would enhance the robustness and applicability of the findings.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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