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Systematic Review

An Overview of Exercise Training in Cardiac Rehabilitation Programs in Sub-Saharan Africa: A Systematic Review

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Abstract

Introduction: This study aimed to provide an overview of the research involving exercise training programs in cardiac rehabilitation programs in Sub-Saharan Africa (SSA).

Methods: Relevant articles were searched in PubMed, LILACS, Web of Science, and Google Scholar using the keywords and medical subject headings Cardiac Rehabilitation AND Africa South of the Sahara AND (Exercise OR "Exercise therapy" OR "Exercise Movement Techniques"), without limitation concerning the publication date. To be included in the full analysis, the study had to be a controlled clinical trial designed and conducted in SSA, in which patients with cardiovascular diseases (CVD) carried out an exercise training program.

Results: The searches resulted in 53 articles, of which 4 met all the inclusion criteria. The trials involved 374 participants with different cardiovascular diseases. The protocols used consisted of aerobic and combined (aerobic and resistance) training programs. Training sessions lasted up to 60 minutes and were held 3 times per week for 8-12 weeks at different training intensities throughout the studies.

Conclusions: The current study shows that aerobic and combined training are effective in promoting beneficial effects on various cardio-respiratory variables in CVD patients. However, the effects of training programs on patients with CVD remains insufficiently investigated in SSA. Moreover, there is a lack of studies aiming to design exercise training programs that take into account the socio-economic challenges of the SSA region in the management of the main CVD.

Keywords: Africa South of the Sahara; Cardiovascular Diseases; Cardiac Rehabilitation; Exercise Therapy

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Introduction

Historically, communicable, maternal and perinatal diseases as well as nutritional deficiencies represented predominant public health problems in Sub-Saharan Africa (SSA).[1,2] However, current data indicates that the region is facing an increasing burden of non-communicable diseases, such as stroke and heart disease, which constitute the principal components of cardiovascular diseases (CVD).[3,4] This increasing burden of CVD constitutes a consequence of the epidemiologic transition triggered mostly by the regional economic transition.[5] Although CVD represents major public health problems in industrialized countries, the SSA region is only in the early stages of such epidemiologic transition. However, current data as well as projections regarding CVD and other major chronic diseases are worrying, as they predict a rise from 28% morbidity and 35% mortality in 1990 to 60% and 65%, respectively, by 2020.[6] Young adults residing in urban areas and, increasingly, those in the low socioeconomic strata are mostly affected by CVD, which results in a significant economic challenge at individual, household, family, and government levels.[7] Therefore, there is justification for preventive and therapeutic strategies to mitigate observed adverse trends in CVD. Several initiatives such as reduction in dietary salt intake,[8] increased fruit intake,[9] use of mass media,[10,11] and health promoting activities in schools have been shown to be effective approaches for implementing the principles and practice of health promotion. Although the beneficial effects of exercise have been widely demonstrated with

various exercise programs,[12] this therapeutic strategy seems to be under-promoted in the rehabilitation of CVD in SSA. This study aimed to determine briefly the state of research involving physical exercise in cardiac rehabilitation in the SSA region through a mini-review of literature.

Methods

Search Strategy and Identification of Trials

A literature review allows researchers to access findings on four electronic databases: PubMed, LILACS, Web of Science, and Google Scholar, without limitation concerning the publication date. The following keywords and medical subject headings were used in the search: Cardiac Rehabilitation AND Africa South of the Sahara AND (Exercise OR "Exercise therapy" OR "Exercise Movement Techniques"); the results were limited to articles in the languages of English, Portuguese, or French. One author performed the article search and forwarded the results from each electronic database to the StArt tool (version 2.3.4.2),[13] a systematic review tool support that allows the centralization of databank results, automatic identification of redundant trials, and easiest management of trial selection and extraction processes. Afterwards, two authors independently evaluated the title and abstract of each trial in the databank through the StArt tool and excluded irrelevant trials in accordance with the inclusion criteria. Then, a full-text review was performed. After each selection step (title, abstract, and full-text evaluation successively), both authors checked the agreement of their databanks of accepted trials. In the event of a disagreement, a discussion that involved the third reviewer was conducted.

Study Selection

The studies included met the following criteria.

Study Design

Only controlled clinical trials designed and performed in Sub-Saharan Africa were included.

Participants

Only studies of cardiopathic patients were selected.

Intervention

Patients participated in exercise-training programs with single or multiple components. The intensity, duration, frequency, type, and length of exercise in each article were recorded.

Outcome Measures

Main outcome measures were recorded without any restriction.

Data Extraction

The following data was extracted from the included studies: participants' data (sample size, mean age, studied groups, and clinical status), exercise-training program parameters (intensity, duration, frequency, type, and length of exercise). The result sections were studied and all relevant results related to the training intervention effects on main or clinical outcomes were extracted and interpreted.

Results

The searches of electronic databases resulted in 53 clinical trials, of which 49 were excluded by the title and abstract screening; 4 selected articles remained.

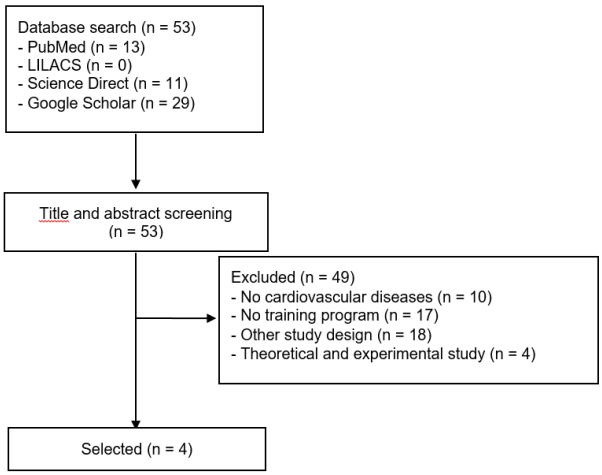

Figure 1. Flow chart of the study

Characteristics of Included Studies

Participants

The studies involved 374 participants with a mean age of 53.97 years with hypertension (n = 254), hypertensive heart disease (n = 50), chronic heart failure (n = 40), coronary heart disease (n = 15), rheumatic heart disease (n = 6), valvular heart disease (n = 5), or idiopathic cardiomyopathy (n = 4).

Interventions

The trials included basically two different exercise programs: aerobic[14, 15] and combined training.[16, 17] Training sessions were held 3 times per week for 8 to 12 weeks at different training intensities.

Effects of Exercise

The effects of training on the main variables are described in Table 1.

Discussion

To the best of the authors' knowledge, this is the first study to investigate the state of research involving exercise training programs in cardiac rehabilitation in SSA. As a preliminary observation, the low number of included articles can be seen as reflecting the scarcity of studies involving exercise training programs designed to manage cardiovascular diseases in sub-Saharan Africa. In most cases, the literature related to cardiac rehabilitation in sub-Saharan Africa consisted of descriptive or epidemiological studies which highlight the emergency represented by the current burden of CVD.[18] Moreover, most of the intervention studies

focused on assessing the effectiveness of comprehensive strategies for the primary prevention and control of cardiovascular risk factors.[8,9] It should be emphasized that the SSA region is already in the early stages of its epidemiologic transition;[19] thus, it is still a priority to achieve a significant impact on projections regarding CVD and other major chronic diseases by promoting public policies firstly oriented on strategies for the prevention and control of the main cardiovascular risk factors. Within this general context, exercise training programs in the cardiac rehabilitation of CVD patients, as a secondary prevention strategy, get little attention.

Table 1. Characteristics of Selected Studies

Studies	Participants (clinical status, group, n, mean age)	Intervention (training modality, intensity, frequency, duration)	Main variables	Main results
Siriku and Okoye, 2013 [15]	245 participants with hypertension. Exercise Group (140), Control Group (105), 58.40±6.91 years	8 weeks of interval training program at moderate intensity (60-79% of HR max) performed 3 days/week, for 45-60 minutes.	Systolic and diastolic blood pressure, VO2 max, pulse pressure	The study demonstrated a rationale basis for the adjunct role of long-term moderate intensity interval exercise training in the downregulation of blood pressure and pulse pressure, a major cardiovascular event risk factor.
Ajiboye et al., 2013 [16]	32 participants with chronic heart failure, 54.2±1.9 years	12 weeks of aerobic and resistance training, performed 3 days/week during 60 minutes.	Cardio-respiratory variables, body composition	Exercise training may improve cardiorespiratory and body composition variables in patients with chronic heart failure.
Kpadonou et al., 2013 [14]	27 participants with coronary heart disease (n = 10; 45.8 ± 11.1 years), heart failure (n = 8; 43.25 ± 8.8 years), and hypertension (n = 9; 43.0 ± 9.7 years)	10 weeks of aerobic training at intensities corresponding to levels 11 (medium) and 13 (little difficulty) of the Borg scale, performed 3 days/week for 60 minutes.	Systolic and Diastolic Blood Pression, Heart Rate, BMI	This cardiac rehabilitation program appears to improve cardiorespiratory and body composition variables
Awotidebe et al., 2016 [17]	70 participants; hypertensive heart disease (n = 50), rheumatic heart disease (n = 6), ischaemic heart disease (n = 5), valvular heart disease (n = 5), idiopathic cardiomyopathy (n = 4). Exercise group (n = 35; 68.9±6.5 years) or control group (n = 35; 64.3±12.3 years)	8 weeks of aerobic and resistance exercises performed at 60-70% of maximal heart rate and 75% of new 1RM, three sessions per week lasting 30 to 60 minutes.	VO2 max, Activity of Daily Living, 6MWD, Hand Grip Strength Measure,	Cardiac rehabilitation exercise protocols involving self-paced walking, sit-to-stand and upper extremity dynamic strength training improved activity of daily living, walking and functional capacity in patients with stable chronic heart failure.

Briefly, the trials concluded that aerobic and combined (aerobic and resistance) training have been effective in promoting beneficial effects on various cardio-respiratory variables in patients with hypertension (67% of participants), hypertensive heart disease, and chronic heart failure. Evidence showed that these diseases are currently among the main CVD in the SSA region,[20] and according to the available projections, it is expected that their impact will be greater in the coming years.[21] Nevertheless, other evidence indicated an increasing risk for other CVD, such as diabetes[22] and stroke[23] in the SSA region. Therefore, studying, in the SSA region, the contribution of exercise training to improving physiological functions of patients with such diseases could be of great relevance. The trials involved only aerobic[14, 15] and combined[16, 17] training programs. In addition to pharmacological[24] and non-pharmacological therapeutic strategies,[25] exercise training is an essential intervention for improving physical function in CVD patients. Guidelines are based on vast evidence that demonstrates the effects of exercise protocols on improving specific physiological functions threatened by the CVD process.[26, 27] For instance, it has been firmly established that aerobic and resistance training improves arterial stiffness,[28] lipid profiles and inflammatory status [29], and modifies cardiovascular disease risk factors.[30] Thus, it can be seen that the results of the trials in the current study are consistent with those of previously reported studies. However, these studies involved exercise training programs which constitute a small part of the known and recommended exercise modalities in CVD management. Moreover, there are no studies aiming to design an exercise training program adapted to local socio-economic challenges. Therefore, investigating the effects of other exercise programs designed according to local socio-economic conditions in order to develop therapeutic methods as secondary prevention strategies in the management of CVD in SSA seems to be a relevant issue. The current review has some limitations. First, the heterogeneity of the included clinical trials (regarding the populations' clinical status, cardiovascular variables, and parameters of the exercise training programs) hindered the performance of a meta-analysis which could accurately determine the magnitude of the improvement in each cardiovascular variable triggered by each exercise training program. Secondly, these findings cannot be extrapolated to other CVD in the SSA region. Furthermore, the studied trials were designed to investigate the effects of aerobic and combined training only.

Conclusions

The findings of this brief review show that the effectiveness of exercise training in cardiac rehabilitation remains under-investigated. Moreover, there is a lack of research aiming to design exercise training programs that take into account the socio-economic challenges of the SSA region in the management of the main CVD. Further studies with higher methodological quality are

needed to investigate the effects of different exercise training modalities and their combinations in patients with diverse CVD.

Authors' Contributions

EF: Study concept and design; analysis and interpretation of data; preparation of manuscript. SA: Study design; analysis and interpretation of data; preparation of manuscript. GMK: Preparation of manuscript.

Conflict of Interest

The authors declare that they have no conflicts of interest.

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References

1. Abudu O, Akinkugbe A. Clinical causes and classification of perinatal mortality in Lagos. Int J Gynaecol Obstet. 1982;20(6):443-7. pmid: 6130990.
2. Datta P, Laga M, Plummer FA, Ndinya-Achola JO, Piot P, Maitha G, et al. Infection and disease after perinatal exposure to Chlamydia trachomatis in Nairobi, Kenya. J Infect Dis. 1988;158(3):524-8. pmid: 3411148.
3. Bloomfield GS, Vedanthan R, Vasudevan L, Kithei A, Were M, Velazquez EJ. Mobile health for non-communicable diseases in Sub-Saharan Africa: a systematic review of the literature and strategic framework for research. Global Health. 2014;10:49. doi: 10.1186/1744-8603-10-49. pmid: 24927745.
4. Dagadu HE, Patterson EJ. Placing a Health Equity Lens on Non-communicable Diseases in sub-Saharan Africa. J Health Care Poor Underserved. 2015;26(3):967-89. doi: 10.1353/hpu.2015.0097. pmid: 26320927.
5. Omran AR. The epidemiologic transition. A theory of the Epidemiology of population change. 1971. Bull World Health Organ. 2001;79(2):161-70. pmid: 11246833.
6. Murray CJ, Lopez AD, Jamison DT. The global burden of disease in 1990: summary results, sensitivity analysis and future directions. Bull World Health Organ. 1994;72(3):495-509. pmid: 8062404.
7. Kengne AP, June-Rose McHiza Z, Amoah AG, Mbanya JC. Cardiovascular diseases and diabetes as economic and developmental challenges in Africa. Prog Cardiovasc Dis. 2013;56(3):302-13. doi: 10.1016/j.pcad.2013.10.011. pmid: 24267437.
8. Cappuccio FP, Kerry SM, Micah FB, Plange-Rhule J, Eastwood JB. A community programme to reduce salt intake and blood pressure in Ghana [ISRCTN88789643]. BMC Public Health. 2006;6:13. doi: 10.1186/1471-2458-6-13. pmid: 16433927.
9. Adebawo O, Salau B, Ezima E, Oyefuga O, Ajani E, Idowu G, et al. Fruits and vegetables moderate lipid cardiovascular risk factor in hypertensive patients. Lipids Health Dis. 2006;5(1):14. doi: 10.1186/1476-511X-5-14. pmid: 16753064.
10. Rossouw JE, Jooste PL, Chalton DO, Jordaan ER, Langenhoven ML, Jordaan PC, et al. Community-based intervention: the Coronary Risk Factor Study (CORIS). Int J Epidemiol. 1993;22(3):428-38. pmid: 8359958.
11. Steyn K, Steyn M, Swanepoel AS, Jordaan PC, Jooste PL, Fourie JM, et al. Twelve-year results of the Coronary Risk Factor Study (CORIS). Int J Epidemiol. 1997;26(5):964-71. pmid: 9363516.
12. Cornish AK, Broadbent S, Cheema BS. Interval training for patients with coronary artery disease: a systematic review. Eur J Appl Physiol. 2011;111(4):579-89. doi: 10.1007/s00421-010-1682-5. pmid: 20972578.
13. Fabbri S, Silva C, Hernandes E, Octaviano F, Di Thommazo A, Belgamo A, editors. Improvements in the StArt tool to better support the systematic review process. 20th International Conference on Evaluation and Assessment in Software Engineering; 2016.
14. Kpadonou TG, Fiogbé E, Datié AM, Alagnidé E, Niama Nata D, Houngbedji G, et al. Preliminary Results of a Cardiac Rehabilitation Program in Patients with Compensated Heart Diseases in Sub-Saharan Africa (Benin): A Pilot Study. Int J Phys Med Rehabil. 2013;04(07). doi: 10.4172/2329-9096.1000160.
15. Sikiru L, Okoye GC. Effect of interval training programme on pulse pressure in the management of hypertension: a randomized controlled trial. Afr Health Sci. 2013;13(3):571-8. doi: 10.4314/ahs.v13i3.7. pmid: 24250291.
16. Ajiboye OA, Anigbogu CN, Ajuluchukwu JN, Jaja SI. Therapeutic Effects of Exercise Training On Selected Cardio-Pulmonary Parameters and Body Composition of Nigerians with Chronic Heart Failure (A Preliminary Study). Nig Q J Hosp Med. 2013;23(4):295-301. pmid: 27276758.
17. Awotidebe TO, Adedoyin RA, Balogun MO, Adebayo RA, Adeyeye VO, I. Oke K, et al. Effects of Cardiac Rehabilitation Exercise Protocols on Physical Function in Patients with Chronic Heart Failure: An Experience from a Resource Constraint Nation. Int J Clin Med. 2016;07(08):547-57. doi: 10.4236/ijcm.2016.78060.
18. Moran A, Forouzanfar M, Sampson U, Chugh S, Feigin V, Mensah G. The epidemiology of cardiovascular diseases in sub-Saharan Africa: the Global Burden of Diseases, Injuries and Risk Factors 2010 Study. Prog Cardiovasc Dis. 2013;56(3):234-9. doi: 10.1016/j.pcad.2013.09.019. pmid: 24267430.
19. Mensah GA. A heart-healthy and "stroke-free" world through policy development, systems change, and environmental supports: a 2020 vision for sub-Saharan Africa. Ethn Dis. 2003;13(2 Suppl 2):S4-12. pmid: 13677406.
20. Walker R. Hypertension and stroke in sub-saharan Africa. Trans R Soc Trop Med Hyg. 1994;88(6):609-11. pmid: 7886746.
21. Fourcade L, Paule P, Mafart B. [Arterial hypertension in sub-Saharan Africa. Update and perspectives]. Med Trop (Mars). 2007;67(6):559-67. pmid: 18300516.
22. Mensah GA. Descriptive epidemiology of cardiovascular risk factors and diabetes in sub-Saharan Africa. Prog Cardiovasc Dis. 2013;56(3):240-50. doi: 10.1016/j.pcad.2013.10.014. pmid: 24267431.
23. Chin JH. Stroke in sub-Saharan Africa: an urgent call for prevention. Neurology. 2012;78(13):1007-8. doi: 10.1212/WNL.0b013e318248df95. pmid: 22454267.
24. Nolan RP, Jong P, Barry-Bianchi SM, Tanaka TH, Floras JS. Effects of drug, biobehavioral and exercise therapies on heart rate variability in coronary artery disease: a systematic review. Eur J Cardiovasc Prev Rehabil. 2008;15(4):386-96. doi: 10.1097/HJR.0b013e3283030a97. pmid: 18677161.
25. Agrawal H, Aggarwal K, Littrell R, Velagapudi P, Turagam MK, Mittal M, et al. Pharmacological and non pharmacological strategies in the management of coronary artery disease and chronic kidney disease. Curr Cardiol Rev. 2015;11(3):261-9. pmid: 25981315.
26. Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Bohm M, et al. 2013 ESH/ESC guidelines for the management of arterial hypertension: the Task Force for the Management of Arterial Hypertension of the European Society of Hypertension (ESH) and of the European Society of Cardiology (ESC). Eur Heart J. 2013;34(28):2159-219. doi: 10.1093/eurheartj/eht151. pmid: 23771844.
27. Millar PJ, Goodman JM. Exercise as medicine: role in the management of primary hypertension. Appl Physiol Nutr Metab. 2014;39(7):856-8. doi: 10.1139/apnm-2014-0006. pmid: 24773307.

28. Li Y, Hanssen H, Cordes M, Rossmeissl A, Endes S, Schmidt-Trucksass A. Aerobic, resistance and combined exercise training on arterial stiffness in normotensive and hypertensive adults: A review. Eur J Sport Sci. 2015;15(5):443-57. doi: 10.1080/17461391.2014.955129. pmid: 25251989.
29. Afshar R, Shegarfy L, Shavandi N, Sanavi S. Effects of aerobic exercise and resistance training on lipid profiles and inflammation status in patients on maintenance hemodialysis. Indian J Nephrol. 2010;20(4):185-9. doi: 10.4103/0971-4065.73442. pmid: 21206679.
30. Sousa N, Mendes R, Abrantes C, Sampaio J, Oliveira J. Long-term effects of aerobic training versus combined aerobic and resistance training in modifying cardiovascular disease risk factors in healthy elderly men. Geriatr Gerontol Int. 2013;13(4):928-35. doi: 10.1111/ggi.12033. pmid: 23441809.