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ORIGINAL RESEARCH

Effects of a 12-week aerobic dance programme on diastolic blood pressure in stage one hypertensive adults

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Abstract

Hypertension which impacts over 1.5 billion people globally is a crucial health challenge accountable for more than 10.8 million early deaths yearly. Our study used an experimental design to investigate the effects of aerobic dance programme on diastolic blood pressure levels in stage one hypertensive adults over a 12-week period. The study participants were randomly allocated into either the experimental or control groups. Diastolic blood pressure measurements were collected using a mercury sphygmomanometer at baseline and post programme. The 12-week aerobic dance programme entailed three 45-minute sessions per week, at a moderate intensity. The paired samples t-test was used to compare mean differences within the groups with the significance level set at $P<0.05$. Findings showed that mean diastolic blood pressure of participants in the experimental group was 93.11±3.708 mmHg and 91.61±4.340 mmHg at baseline and post programme while that of the control group was 92.39±3.032 mmHg and 92.06±6.655 mmHg respectively. This implies that there was a marginal reduction of -1.50 mmHg in diastolic blood pressure of the experimental group while the control group remained relatively constant at -0.33mmHg after the programme. Paired sample t-test results confirmed no statistically significant effects ($t(17)=1.129$, $p=.275$) for experimental group as well as the control group ($t(17)=.257$, $p=.800$). This study concluded that participating in an aerobic dance programme at a moderate intensity for 12 weeks did not statistically significantly reduce diastolic blood pressure of adults with stage one hypertension. Future studies on this population should investigate additional influencing factors and varying training intensity to assess any other effects.

Introduction

A major worldwide health issue that affects around 1.5 billion people is hypertension (Charchar et al., 2024). More than 10.8 million premature deaths occur annually as a result of it (GBD 2019 Risk Factors Collaborators, 2020). Diastolic blood pressure (DBP) of 90 mmHg or above is indicative of it (Mirzaei et al., 2020). The primary cause of death worldwide (Forouzanfar et al., 2017) is cardiovascular illnesses, of which hypertension is a major contributor. It also poses an emergency risk to other health issues such as stroke, blindness, and kidney ailments (Fuchs & Whelton, 2020). Numerous variables can contribute to hypertension, such as inactivity, poor eating and drinking habits, smoking, alcohol consumption, genetics, certain medications, aging, contemporary life, being overweight, stress, and ignorance (Legese & Tadiwos, 2020; Ntiyani et al., 2022; Schutte et al., 2023). In Africa, hypertension affects more than 46% of adults and is very prevalent (Bosu et al., 2019; Mills et al., 2016; Okello et al., 2020). Many obstacles have to be overcome in order to effectively manage hypertension in Sub-Saharan Africa, including a dearth of medical facilities, excessive prescription prices, a shortage of trained healthcare professionals, unequal access to healthcare, particularly in rural regions, and high rates of poverty (Oleribe et al., 2019).

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The prevalence of hypertension in Uganda ranges from 26.5% (Guwatudde et al., 2015) to 31.5% (Lunyera et al., 2018) among adults 18 years of age and obove. The primary causes of hypertension in Uganda are ignorance and inefficient management brought on by modifiable risk factors (Ataklte et al., 2015; Guwatudde et al., 2015). Additionally, the majority of Ugandans, particularly those residing in rural regions, lack access to and the financial means to pay for hypertension medication (Armstrong-Hough et al., 2018; Lwabi, 2018; Whelton et al., 2018).

Therefore, more affordable treatments that can help Ugandans manage their hypertension must be established. Health behavioral modifications, such as leading an active lifestyle and adhering to a healthy diet, are practical non-pharmaceutical strategies that offer physiological advantages and support the management of hypertension (Whelton et al., 2018). Frequent exercise lowers blood pressure via reducing arterial stiffness as a result of favorable vascular elastin and collagen content remodeling (Pedralli et al., 2016; Tanaka, 2019). Frequent exercise also lowers blood pressure by promoting vasodilation through decreased renin activity (Baffour-Awuah et al., 2024), sympathetic tone reduction from lessened nervous system activation (Lee et al., 2022), and increased nitric oxide produced by endothelial nitric oxide synthase activity (Gronek et al., 2020). Specifically, aerobic dance has been shown to dramatically lower blood pressure. While some studies have reported contradictory findings, many studies worldwide have documented the beneficial effects of aerobic dance on DBP.

Conceição et al. (2016), for example, looked into how dance therapy affected people with hypertension and discovered that the treatment group's DBP significantly decreased. Pregnant women's immediate blood pressure responses to aerobic dance were studied by Daniel et al. (2019), who discovered a substantial drop in DBP following exercise. Research and interventions on the impact of scheduled aerobic dance on the DBP of individuals with stage one hypertension are scarce in Africa, particularly in Uganda. Therefore, the purpose of this study was to determine whether a 12-week aerobic dance programme may lower the DBP of adults with stage one hypertension.

Methods

Study Design

This study used an experimental study design to determine the effect of aerobic dance on DBP in stage one hypertensive adults. The study participants were randomly assigned into either the experimental or control groups. A 12-week aerobic dance programme was implemented and its impact on DBP was noted. While the control group did not take part in the programme and continued with their regular daily activities, the experimental group engaged in a 12-week aerobic dance programme. At baseline and after the programme, data were gathered from persons with stage one hypertension who visited Kyambogo University Medical Center.

Sample Size and Sampling Technique

G*Power software (version 3.1.9.4) was used to calculate the sample size of participants prior to data collection. The software input parameters included two tails, an effect size of 0.8, an error probability of 0.05, and a target power of 80% that is acknowledged in most experimental studies (Bausell & Li, 2002). The study sample was 52 participants, with 26 participants in the experimental and 26 in the control groups. To account for dropouts, an additional six people were added to the trial, bringing the total number of participants to 58. Out of the 58 participants, 36 finished the study. Adults with stage one hypertension were recruited for the trial via purposive sampling, and they were randomized to either the experimental or control groups. Participants in the study comprised community members who were visiting the Kyambogo University Medical Center as well as staff, and students from Kyambogo University.

Inclusion and Exclusion Criteria

Participants in the study who were physically challenged, pregnant, or engaged in any kind of organized physical exercise were not allowed to participate in the study. Participants with a history of stroke, heart failure, liver disease, type 2 diabetes, antihypertensive medication use, smoking, alcohol consumption, and other significant health conditions were also excluded from the study. Stage one hypertension adults aged 30 to 59 were included in this study.

The Intervention Programme

For a duration of 12 weeks, the exprimental participants participated in an aerobic dance programme. The

Frequency, Intensity, Time, and Type (FITT) principle guidelines for training hypertensive persons were adhered to during the programme. The training was conducted for 45 minutes per session, three days a week (frequency), at a moderate intensity of 40–60% of heart rate reserve, which was tracked by Garmin heart rate monitors and deemed safe for those with stage one hypertension. To guarantee that the moderate intensity was maintained throughout the training sessions, the heart rate monitors were linked via a bluetooth sensor to the squad heart rate software. The experimental group completed the warm-up, aerobics, standing cool-down, muscle-strengthening, and relaxation phases of a training session. Participants in the control group carried on with their usual activities, did not engage in any organized physical exercise, and were followed up weekly to make sure they remained in the study. A qualified nurse kept an eye on the study participants to make sure they were healthy during the duration of the investigation.

Blood Pressure Measurements

A mercury sphygmomanometer (Fizzini S.R.L., Padana sup.317,20090, G3M 110944963023, Vimodrone, Italy) was used to assess the DBP at baseline and after the programme. Prior to the measurements, the participants had five minutes of rest. The participants' arms were held at heart level, bare, and they sat upright in the chair. During the measurement, participants stood with their feet flat on the ground, wore loose-fitting clothing, and did not speak or move. Three measurements were made overall, two minutes between each measurement, all of which were collected from the left arm. In this investigation, the three measurements' means were taken into account for analysis.

Data Analysis

Data were analysed using Statistical Package of Social Sciences (SPSS) verson 20. The paired samples t-test analysis was used to compare mean differences within the groups. The values were considered statistically significant at a *p*-value <0.05 and at 95% confidence interval level.

Results

As much as the study aimed to have an equal representation of both male and female participants in each group, the final completing groups had more male participants (66.7%) and less female participants in the control group (33.3%). For the age, the experimental group had more participants in the 30-39 years (44.4%) and 40-49 years (44.4%) category and the least participants in the 50-59 years (11.1%), whereas the control group had more participants in the 50-59 years category (38.9%) followed by 40-49 years (33.3%) and 30-39 years with (27.8%). Their other demographic characteristics are presented in Table 1.

Table 1

Demographic information of the study participants.

Variables		EG		CG	
		n	%	n	%
Gender	Female	9	50.0	6	33.3
	Male	9	50.0	12	66.7
Marital Status	Single	5	27.8	0	0.0
	Married	12	66.7	18	100.0
	Divorced	1	5.6	0	0.0

EG: Experimental Groups; CG: Control Group.

Diastolic Blood Pressure in Stage 1 Hypertensive Adults

Both descriptive and inferential sets of results were derived and presented in the following subsections. Figure 1 shows that DBP results for both control and experimental groups were taken during pre-test at 0 weeks and post-test at 12 weeks. The two graphs in both cases run closely to each other which implies that the changes over the 12 weeks of aerobic dance were minimal. Generally the graphs show that there was a slightly small decrease in DBP for the experimental group compared to the control group considering that the post-test graph is seen to be generally below the pre-test graph. Descriptively this implies that Aerobic dance had an effect on DBP for the participants.

Further descriptive results are presented in Table 2 which shows the magnitude of the changes for both the experimental and control groups.

In general, there was a small drop in the DBP of -1.50mmHg in the experimental group between the post-test and pre-test readings. There was a minimal drop in the control group of -0.33mmHg. These results imply that the aerobic dance programme had minimal effect on DBP of the participants in the experimental group. When these results were plotted, Figure 2 was derived.

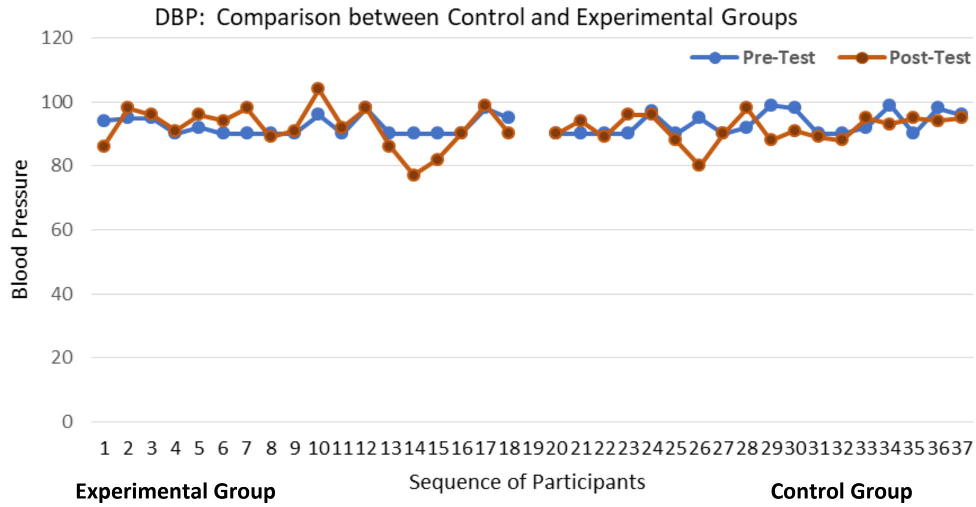

Figure 1. Diastolic blood pressure of the Study Participants.

Table 2
Changes in diastolic blood pressure (n=18).

Groups	Post-test DBP		Pre-test DBP		Change in DBP
	Mean	SD	Mean	SD	
Experimental Group	91.61	4.340	93.11	3.708	-1.50mmHg
Control Group	92.06	6.655	92.39	3.032	-0.33mmHg

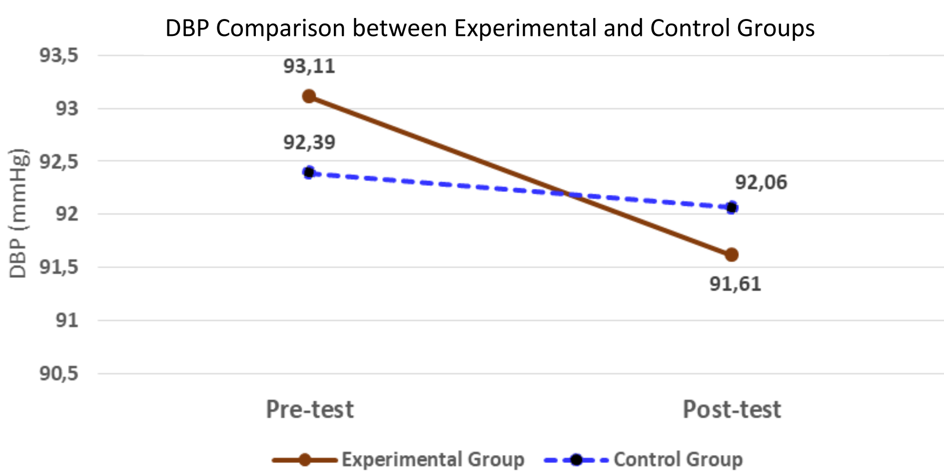

Figure 2. Diastolic blood pressure comparision between experimental and control groups.

Figure 2 further compared DBP of experimental and control groups. The experimental group had a mean DBP of 93.11mmHg at baseline. However after a 12-week aerobic dance programme, DBP of participants in the experimental group reduced from 93.11 (baseline) to 91.61mmHg (post-test) (-1.50mmHg). On the other hand, the control group had a mean DBP of 92.39 at baseline which reduced to 92.06 after 12 weeks. There was small reduction between baseline and post test of -0.33mmHg. This implies that aerobic dance programme had an effect on DBP of participants in the experimental group though the reduction was small.

Diastolic Blood Pressure Disaggregated by Gender

Upon disaggregating the results by gender (Table 3), the study equally revealed that there was an increase in DBP of male participants (+1.44mmHg) and marked decrease of (-4.44mmHg) in female participants in the experimental group. On contrary, DBP of male participants in the control group reduced by -1.25mmHg while that of female participants increased by +1.50mmHg. Further, as for the experimental group the drop in DBP was only for the female participants (-4.44mmHg) compared to the male participants where there was a slight increase (+1.44mmHg) implying that the aerobic dance benefitted the female participants more than their male counterparts. The study established a slight decrease in DBP of the female compared to the male who's DBP slightly increased.

Paired Samples t-test analysis for Diastolic Blood Pressure in stage one hypertensive individuals

The paired-sample t-test analysis on DBP was conducted and three sets of findings were obtained. These include paired samples statistical results, correlation results and paired samples results as presented in Tables 4, 5 and 6.

The first step in this analysis was to establish whether there was a difference in the mean values of the DBP pre-test results compared to the post-test results. It was established that the results of the experimental group show a significant difference between the mean of the post-test to the pre-test of -1.5mmHg (91.61 – 93.11) compared to that of the control group of only -0.33mmHg (92.06 – 92.39) as shown in Table 4. The paired correlation results for the DBP were as shown in Table 5.

The correlation results show that the pre-test and post-test results in the experimetal group were not correlated considering that their p-value of 0.922 is greater than 0.05, while the control group results were found to be correlated (p = .012). This indicates that there is no linear relationship between the pre-test and post-test results in the experimental group and this could mean that the post-test DBP results for any given participant may not have been related to the corresponding pre-test reading.

It was then important to establish whether the calculated sample mean falls into the confidence interval and whether the results are statistically significant or not. The results were as presented in Table 6.

Table 3

Changes in diastolic blood pressure disaggregated by gender (n=9).

Groups	Gender	Post-test DBP		Pre-test DBP		Change in DBP
		Mean	SD	Mean	SD	
Experimental Group	Male	93.22	3.420	91.78	3.073	+1.44 mmHg
	Female	90.00	4.743	94.44	3.972	-4.44 mmHg
Control Group	Male	91.50	7.787	92.75	3.019	-1.25 mmHg
	Female	93.17	3.869	91.67	3.204	+1.50 mmHg

Table 4

Paired samples statistical results for diastolic blood pressure.

Groups		Mean	SD	SEM
Experimental Group	Pre-test DBP	93.11	3.708	.874
	Post-test DBP	91.61	4.340	1.023
Control Group	Pre-test DBP	92.39	3.032	.715
	Post-test DBP	92.06	6.655	1.569

Table 5

Correlation of diastolic blood pressure in the groups.

Groups	Tests	Correlation	p
Experimental Group	Pre-test & Post-test DBP	.025	.922
Control Group	Pre-test & Post-test DBP	.576	.012*

** p < 0.05*

Table 6

Paired sample results for pre-test-post-test comparison of diastolic blood pressure.

Groups	Paired differences			95% confidence		t	df	p
	Mean	SD	SEM	Lower	Upper			
Experimental Group	1.500	5.639	1.329	-1.304	4.304	1.129	17	.275
Control Group	.333	5.499	1.296	-2.401	3.068	.257	17	.800

From the results presented in Table 6, the calculated mean of the experimental group was 1.500 mmHg while the 95% confidence interval of the difference ranged from -1.304 to 4.304. This implies that the calculated mean indeed falls within the confidence interval. The calculated mean for the control group was equally within the 95% confidence interval considering that it was -.333mmHg and the interval ranged from -2.401 to 3.068. The t-test analysis of the experimental group was established not to be statistically significant with a p-value of .275 greator than a set p-value of 0.05. The t-test analysis of the control group was also not statistically significant as the results were: $p = .800 > .05$.

Discussion

This study investigated the effect of aerobic dance programme on DBP of stage one hypertensive adults. After a 12-week aerobic dance programme, we discovered that aerobic dance did not statistically significantly lower the experimental group's DBP. We also found that following the 12-week period, the control group's DBP stayed largely unchanged. The results of this study also showed that aerobic dance decreased the DBP of the experimental group's female participants more than that of the group's male participants. Additionally, the control group's male participants' DBP marginally decreased relative to that of their female counterparts, whose DBP significantly increased.

These results reported by Gao et al. (2023) are similar to the current study. They conducted a meta-analysis to investigate the impact of aerobic exercise on DBP in middle-aged and older adults. They found that aerobic exercise intervention had no significant effect on DBP. Similarly, De Luna et al. (2024) investigated the acute effect of aerobic exercise session on blood pressure in women with rheumatiod arthritis and hypertension. Their findings are supported by the findings of our study. These results could be attributed to the fact that studies like that of Edwards et al. (2023) have shown that DBP reduction depends on the type of training. They looked into workout regimens that lower blood pressure in a meta-analysis. Aerobic exercise, mixed training, isometric training, and dynamic resistance training were all taken into consideration. They concluded that, in contrast to the current study's utilization of aerobic exercise, resistance training demonstrated a much lower DBP than other approaches.

The results from the current study could also be attributed to the fact that studies like that of Almutawa et al. (2020) have shown that blood pressure reduction depends on the intensity of training. They established that high blood pressure reduction is achieved when high intensity training is used contrary to our study intervention that used moderate intensity training. The results of Almutawa et al. (2020) are similar to those presented by Paoli et al. (2013) in their investigation on the impact of endurance training, low-intensity circuit training, and high-intensity circuit training on middle-aged, overweight men's blood pressure. They proved that exercise training has a minor impact on DBP during low-intensity exercises and a maximum effect during high-intensity workouts. Their research revealed that greater exercise intensities are necessary for a statistically significant drop in DBP. Consequently, the study's moderate intensity may have contributed to the non-significant decline in DBP that was observed. The failure to control for other confounding factors, such as diet and stress, which also raise blood pressure, may have affected the outcomes of this study.

Whereas the findings of this study were not statistically significant, other studies have demonstrated that aerobic exercise can significantly reduce DBP. Gunjal et al. (2013) investigated the impact of aerobic interval training on blood pressure. They found a significant decrease in DBP after a 12 week intervention. Maruf et al. (2016) examined how aerobic dancing training affected the blood pressure of people on two antihypertensive medications who had uncontrolled hypertension. Their investigation showed a noteworthy decline in DBP. In contrast to the present study, which included aerobic dance training, this reduction might have been impacted by the combination of medications and aerobic exercise. The results from the current study are in contrast with the results from a meta-analysis conducted by (Zhu et al., 2022). They looked into how exercise interventions affected the blood pressure of hypertensive patients. According to their research, DBP significantly decreased. Kazeminia et al. (2020) investigated the impact of exercise on DBP in older adults with hypertension. They found a statistically significant reduction in DBP after the exercise intervention.

Cornelissen & Smart (2013) investigated the impact of exercise training on blood pressure in healthy adults. They reported a significant reduction in DBP. The significant results in these studies may be attributed to the fact that all these studies used structured exercise training. The significant reduction could also be attributed to the different approaches that were used in these studies forexample a study of Maruf et al. (2016) used exercise intervention and antihypertensive drugs. Similarly, Daimo et al. (2020) investigated the effect of aerobic exercise on blood pressure and reported a significant reduction in DBP. The results could also be atributed to the fact that aerobic exercise reduces arterial stiffness, increases vasodilation through endothelial nitric oxide synthase activity and reduced renin activity, lowers nervous system activation, mechanisms that lead to lowering blood pressure (Baffour-Awuah et al., 2024; Lee et al., 2022; Pedralli et al., 2016; Tanaka, 2019).

Much as DBP did not significantly reduce in the current study, it has been reported that reduction in DBP reduces the risk of developing cardiovascular diseases (Canoy et al., 2022; Ettehad et al., 2016). This implies that a reduction of 1.50mmHg of in the current study is clinically important since it can influence a reduction in cardiovascular events much as it was statistically not significant.

Conclusions

This study concluded that participating in an aerobic dance programme at a moderate intensity for 12 weeks did not statistically significantly reduce DBP of adults with stage one hypertension. The study also concludes that aerobic dance decreased the DBP of female participants in the experimental group than their male counterparts. It was further noticed that the aerobic dance alone is not effective in the reduction of the DBP of adults with stage one hypertention. However there could be other lifestyle modifications that can be done hand in hand with aerobic dance such as feeding style and control of stress to effectively reduce the DBP of people with stage one hypertention.

There is need for further investigations with additional focus on other influencing factors of DBP levels as well as in regulating the training intensity used in the intervention. The study recommends that further studies should be conducted on a combination of aerobic dance programme and the human lifestyle such as feeding style and stress control concurrently to understand their effect on DBP stage one hypertention.

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Authors' Contribution

Study Design: LN, EKB, CANN, LW; Data Collection: LN; Statistical Analysis: MM; LN; Manuscript Preparation: LN, EKB; CANN, MM, LW.

Ethical Approval

This study obtained ethical approval from the institute review board of St Mary's Hospital Lacor in Gulu City in Uganda, reference number: LHIREC NO: 0196/12/2021. The study also obtained approval from the Uganda National Council for Science and Technology with registration number HS2202ES. The study was conducted in accordance with the World Medical Association's code of Ethics. A written informed consent was obtained from all participants before data collection.

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Conflict of Interest

The authors hereby declare that there was no conflict of interest in conducting this research.

References

Almutawa, A. M., Al-Shelash, A. A., Al-Gazlan, B. M., Al-Sallali, R. M., Al-Marzougi, R. A., & Al-Sowayan, N. S. (2020). The effects of different quality of exercise on blood pressure and heart rate in healthy female. *Health*, 12(04), 425-435.

Armstrong-Hough, M., Kishore, S. P., Byakika, S., Mutungi, G., Nunez-Smith, M., & Schwartz, J. I. (2018). Disparities in availability of essential medicines to treat non-communicable diseases in Uganda: A poisson analysis using the service availability and readiness assessment. *PLoS One*, 13(2), e0192332.

Ataklte, F., Erqou, S., Kaptoge, S., Taye, B., Echouffo-Tcheugui, J. B., & Kengne, A. P. (2015). Burden of undiagnosed hypertension in sub-saharan africa: A systematic review and meta-analysis. *Hypertension*, 65(2), 291-298.

Baffour-Awuah, B., Man, M., Goessler, K. F., Cornelissen, V. A., Dieberg, G., Smart, N. A., & Pearson, M. J. (2024). Effect of exercise training on the renin–angiotensin–aldosterone system: a meta–analysis. *J Hum Hypertens*, 38(2), 89-101.

Bausell, R. B., & Li, Y. (2002). *Power Analysis for experimental Research. A practical guide for the Biological, Medical and Social Sciences.* (Issue september 2016). Cambridge University Press.

Bosu, W. K., Reilly, S. T., Aheto, J. M. K., & Zucchelli, E. (2019). Hypertension in older adults in Africa: A systematic review and meta-analysis. *PLoS One*, 14(4), e0214934.

Canoy, D., Nazarzadeh, M., Copland, E., Bidel, Z., Rao, S., Li, Y., & Rahimi, K. (2022). How much lowering of blood pressure is required to prevent cardiovascular disease in patients with and without previous cardiovascular disease? *Curr Cardiol Rep,* 24(7), 851-860.

Charchar, F. J., Prestes, P. R., Mills, C., Ching, S. M., Neupane, D., Marques, F. Z., Sharman, J. E., Vogt, L., Burrell, L. M., Korostovtseva, L., Zec, M., Patil, M., Schultz, M. G., Wallen, M. P., Renna, N. F., Islam, S. M. S., Hiremath, S., Gyeltshen, T., Chia, Y. C., … Tomaszewski, M. (2024). Lifestyle management of hypertension: International Society of Hypertension position paper endorsed by the World Hypertension League and European Society of Hypertension. *J Hypertens*, 42(1), 23-49.

Conceição, L. S. R., Neto, M. G., do Amaral, M. A. S., Martins-Filho, P. R. S., & Carvalho, V. O. (2016). Effect of dance therapy on blood pressure and exercise capacity of individuals with hypertension: A systematic review and meta-analysis. *Int J Cardiol*, 220, 553–557.

Cornelissen, V. A., & Smart, N. A. (2013). Exercise training for blood pressure: a systematic review and meta-analysis. *J Am Heart Assoc*, *2*(1), 1-9.

Daimo, M., Mandal, S., Mahmud, M., & Mathivanan, D. (2020). Effect of aerobic exercise on blood pressure in men with hypertension: A randomized controlled study. *Turk J Kinesiol*, 6(1), 32-39.

Daniel, J. A., Nwaogu, E. I., Okoli, S. C., & Nzeribe, E. A. (2019). Acute effect of aerobic dance exercise on blood pressure of normotensive pregnant Nigerian women. *Int Res J Med Med Sci,* 7(1), 28-33.

de Luna, T. A., Rezende, D. A. N., de Brito, L. C., Fecchio, R. Y., Lima, F. R., de Sá Pinto, A. L., de Medeiros Ribeiro, A. C., Bonfiglioli, K. R., Gualano, B., Roschel, H., & Peçanha, T. (2024). A single session of aerobic exercise reduces systolic blood pressure at rest and in response to stress in women with rheumatoid arthritis and hypertension. *J Hum Hypertens*, *38*(2), 168-176.

Edwards, J. J., Deenmamode, A. H. P., Griffiths, M., Arnold, O., Cooper, N. J., Wiles, J. D., O'Driscoll, J. M. (2023). Exercise training and resting blood pressure: a large-scale pairwise and network meta-analysis of randomised controlled trials. *Br J Sports Med,* 57(20), 1317-1326.

Ettehad, D., Emdin, C. A., Kiran, A., Anderson, S. G., Callender, T., Emberson, J., Chalmers, J., Rodgers, A., & Rahimi, K. (2016). Blood pressure lowering for prevention of cardiovascular disease and death: a systematic review and meta-analysis. *The Lancet*, 387(10022), 957-967.

Forouzanfar, M. H., Liu, P., Roth, G. A., Ng, M., Biryukov, S., Marczak, L., Alexander, L., Estep, K., Abate, K. H., Akinyemiju, T. F., Ali, R., Alvis-Guzman, N., Azzopardi, P., Banerjee, A., Bärnighausen, T., Basu, A., Bekele, T., Bennett, D. A., Biadgilign, S., … Murray, C. J. L. (2017). Global burden of hypertension and systolic blood pressure of at least 110 to 115mmHg, 1990-2015. *JAMA-J Am Med Assoc*, *317*(2), 165-182.

Fuchs, F. D., & Whelton, P. K. (2020). High blood pressure and cardiovascular disease. *Hypertension*, 75(2), 285-292.

Gao, W., Lv, M., & Huang, T. (2023). Effects of different types of exercise on hypertension in middle-aged and older adults: a network meta-analysis. *Front Public Health* 11, 1194124.

GBD 2019 Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet,* 396(10258), 1223-1249.

Gronek, P., Wielinski, D., Cyganski, P., Rynkiewicz, A., Zajac, A., Maszczyk, A., Gronek, J., Podstawski, R., Czarny, W., Balko, S., Clark, C. C. T., & Celka, R. (2020). A review of exercise as medicine in cardiovascular disease: Pathology and mechanism. *Aging Dis*, 11(2), 327-340.

Gunjal, S., Shinde, N., Atharuddin Kazi, & Khatri, S. (2013). Effects of interval training on blood pressure and endothelial function in hypertensive patients. *Int J Pharm Sci Invent*, *2*(6), 27-31.

Guwatudde, D., Mutungi, G., Wesonga, R., Kajjura, R., Kasule, H., Muwonge, J., Ssenono, V., & Bahendeka, S. K. (2015). The epidemiology of hypertension in Uganda: Findings from the national non-communicable diseases risk factor survey. *PLoS One*, *10*(9), e0138991.

Kazeminia, M., Daneshkhah, A., Jalali, R., Vaisi-Raygani, A., Salari, N., & Mohammadi, M. (2020). The effect of exercise on the older adult's blood pressure suffering hypertension: Systematic review and meta-analysis on clinical trial studies. *Int J Hypertens*, 2020, 2786120.

Lee, C. K., Lee, J. H., & Ha, M. S. (2022). Comparison of the effects of aerobic versus resistance exercise on the autonomic nervous system in middle-aged women: A randomized controlled study. *Int J Environ Res Public Health*, 19(15), 9156.

Legese, N., & Tadiwos, Y. (2020). Epidemiology of hypertension in ethiopia: A systematic review. *Integr Blood Press C*, *13*, 135-143.

Lunyera, J., Kirenga, B., Stanifer, J. W., Kasozi, S., Van Der Molen, T., Katagira, W., Kamya, M. R., & Kalyesubula, R. (2018). Geographic differences in the prevalence of hypertension in Uganda: Results of a national epidemiological study. *PLoS One*, 13(8), e0201001.

Lwabi, P. (2018, November 5). Blood pressure, cancer drug prices inflated. Monitor. https://www.monitor.co.ug/uganda/news/national/blood-pressure-cancer-drug-prices-inflated-heart-institute-1787994

Maruf, F. A., Akinpelu, A. O., Salako, B. L., & Akinyemi, J. O. (2016). Effects of aerobic dance training on blood pressure in individuals with uncontrolled hypertension on two antihypertensive drugs: A randomized clinical trial. *J Am Soc Hypertens*, *10*(4), 336–345.

Mills, K. T., Bundy, J. D., Kelly, T. N., Reed, J. E., Kearney, P. M., Reynolds, K., Chen, J., & He, J. (2016). Global disparities of hypertension prevalence and control. *Circulation*, 134(6), 441-450.

Mirzaei, M., Mirzaei, M., Bagheri, B., & Dehghani, A. (2020). Awareness, treatment, and control of hypertension and related factors in adult Iranian population. *BMC Public Health*, 20(1), 1-10.

Ntiyani, N., Letamo, G., & Keetile, M. (2022). Prevalence of and factors associated with hypertension, diabetes, stroke and heart attack multimorbidity in Botswana: Evidence from STEPS 2014 survey. *PLoS One*, 17(3), e0265722.

Okello, S., Muhihi, A., Mohamed, S. F., Ameh, S., Ochimana, C., Oluwasanu, A. O., Bolarinwa, O. A., Sewankambo, N., & Danaei, G. (2020). Hypertension prevalence, awareness, treatment, and control and predicted 10-year CVD risk: a cross-sectional study of seven communities in East and West Africa (SevenCEWA). *BMC Public Health*, *20*(1), 1-13.

Oleribe, O. O., Momoh, J., Uzochukwu, B. S. C., Mbofana, F., Adebiyi, A., Barbera, T., Williams, R., & Taylor-Robinson, S. D. (2019). Identifying key challenges facing healthcare systems in Africa and potential solutions. *Int J Gen Med, 12*, 395-403.

Paoli, A., Pacelli, Q. F., Moro, T., Marcolin, G., Neri, M., Battaglia, G., Sergi, G., Bolzetta, F., & Bianco, A. (2013). Effects of high-intensity circuit training, low-intensity circuit training and endurance training on blood pressure and lipoproteins in middle-aged overweight men. *Lipids Health Dis*, 12, 131.

Pedralli, M. ., Waclawovsky, G., & Am, L. (2016). Impact of exercise training on blood pressure and endothelial function in individuals with systemic hypertension. *Austin Sports Med*, *1*(2), 1006.

Schutte, A. E., Jafar, T. H., Poulter, N. R., Damasceno, A., Khan, N. A., Nilsson, P. M., … Tomaszewski, M. (2023). Addressing global disparities in blood pressure control: Perspectives of the International Society of Hypertension. *Cardiovasc Res*, 119(2), 381-409.

Tanaka, H. (2019). Antiaging effects of aerobic exercise on systemic arteries. *Hypertension*, 74(2), 237-243.

Whelton, P. K., Carey, R. M., Aronow, W. S., Casey, D. E., Collins, K. J., Himmelfarb, C. D., … Hundley, J. (2018). 2017 ACC/ AHA/ AAPA/ ABC/ ACPM/ AGS/ APhA/ASH/ ASPC/ NMA/ PCNA Guideline for the prevention, detection, evaluation, and management of high blood pressure in adults: A report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Hypertension,* 71(6), e13-e115.

Zhu, Z., Yan, W., Yu, Q., Wu, P., Bigambo, F. M., & Chen, J. (2022). Association between exercise and blood pressure in hypertensive residents: A meta-analysis. *Evid Based Complement Alternat Med,* 2022, 2453805.