Original Article

Effect of Aerobic Exercise on Some Parameters of Cardiovascular Health among Male Problem Gamblers

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Abstract

Aims: The aim of this study was to assess some parameters of cardiovascular health among male problem gamblers and the possible effect of long-term participation in aerobic exercise training on the parameters. **Materials and Methods:** Three hundred and sixty-eight male volunteers aged between 35 and 55 years, were enrolled in this randomized controlled trial, they were confirmed as problem gamblers from the results obtained from the analysis of the South Oaks Gambling Screen. After the exclusion of 168 participants, 200 participants were randomly assigned to the control group ($n = 100$) and treatment group ($n = 100$), respectively. Body mass index (BMI), waist circumference (WC), heart rate (HR), systolic blood pressure (SBP), and diastolic blood pressure (DBP) were measured. Participants in the treatment group participated in a supervised vigorous-intensity aerobic exercise training program; jogging for 30 min/day at an estimated intensity of 6.32 metabolic equivalents, three times/week, consistently for 1 year. Data were analyzed using the SPSS (version 20 Armonk, NY, USA), and significant difference was determined at the level of $P < 0.05$. **Results:** The findings from this study shows statistically significant improvements in BMI (control: 27.18 ± 0.52, treatment: 21.73 ± 0.30, $P < 0.000$), SBP (control: 134.35 ± 1.63, treatment: 110.69 ± 1.11, $P < 0.000$), DBP (control: 89.18 ± 1.16, treatment: 77.14 ± 0.52, $P < 0.000$), HR (control: 76.85 ± 0.70, treatment: 72.06 ± 0.25, $P < 0.000$), and WC (control: 91.14 ± 0.78, treatment: 86.26 ± 0.41, $P < 0.000$) among participants in the treatment group compared to the control group. **Conclusion:** Vigorous-intensity aerobic exercise training led to a statistically significant decrease in BMI, SBP, DBP, HR, and WC among male problem gamblers.

Keywords: Aerobic exercise, behavioral addiction, cardiovascular risk, gambling disorder, problem gambling

Introduction

Problem gambling is associated with a growing tension in individuals when they are not gambling online or offline, this tensed feeling which includes anxiety and impulsivity is usually calmed by gambling/betting offline or online, this is one of the major symptoms of gambling addiction.[1] Addiction is a disorder of the brain's reward system which develops over time due to consistent exposure to an addictive stimulus.[2] Uncontrolled gambling behavior results to distortions in mental well-being, economic, social, and occupational activities.[3] Problem gambling is an urge to gamble continuously despite the harmful consequences and a personal decision to quit.[4,5]

Sports betting are the activities of predicting the outcome of sports events and placing a wager on them.[6-8] Sleep deprivation is one of the consequences of uncontrolled sports betting activities, this can result to motor and cognitive dysfunction, mood problems, and immunological dysregulation.[9] Problem gamblers often suffer from cardiovascular disease, mental health, and substance use disorders, and they usually have stress-related physical and psychological ill-health because of their frequent gambling activities.[10] Problem gamblers are predisposed to mood disorders and cardiovascular disease because they tend to increase their dependence on alcohol, hard drugs, and cigarette smoking.[11-13]

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Exercise is an effective tool for improving cardiovascular health and minimizing cardiovascular mortality, long-term involvement in exercise might lead to improvements in cardiometabolic parameters and net reduction in blood pressure at rest.[14,15] Both short- and long-term involvement in aerobic and resistance exercises improves mood, quality of life, functional capacity, and minimizes the risk of high blood pressure among healthy individuals.[16] The American College of sports medicine recommends that every adult should accumulate at least 30–60 min/day (≥150 min/week) of moderate-intensity aerobic exercise, or 20–60 min/day (≥75 min/week) of vigorous-intensity aerobic exercise or a combination of moderate and vigorous-intensity aerobic exercises per day.[17]

The aim of this study was to assess some parameters of cardiovascular health among male problem gamblers addicted to sports betting and the possible effect of long-term participation in aerobic exercise training on the parameters.

Materials and Methods

Research design

An exercise intervention study was conducted in Lagos State, Nigeria, from July 2016 to August 2017.

Participants

Three hundred and sixty-eight male volunteers aged between 35 and 55 years were enrolled in this randomized controlled trial, they were confirmed as problem gamblers from the results obtained after the analysis of South Oaks Gambling Screen (SOGS) questionnaire, which they filled.[18] The enrolled participants scored a total average of 2.9, and according to the SOGS, an average score between 1 and 4 signifies some problem with gambling. Participants were recruited from different sports betting centers in Eti-Osa Local Government Area, Lagos State, Nigeria. After the exclusion of 168 participants, 200 participants were randomly assigned to the control group (n = 100) and treatment group (n = 100), respectively. Data were presented using consortium flow diagram for reporting randomized controlled trials [Figure 1]. Table 1 shows the cardiovascular health parameters of subjects in the control group. Table 2 shows the cardiovascular health parameters of subjects in the treatment group.

Anthropometrics

Weight and height were measured using an electronic weighing scale (Accuweight® Hebei, China) and stadiometer, respectively, to obtain the body mass index (BMI) of the participants. Waist circumference (WC) was measured using a standard metric tape.

Measurement of cardiovascular health parameters

Arterial blood pressure was measured using an aneroid sphygmomanometer (Accoson® Ayrshire, UK) and was determined after 3 weeks of constant measurements and readings, before and after 1-year exercise intervention. Blood pressure readings were taken, after a 5-min sitting rest with the arm positioned at the level of the left ventricle. The I and V Korotkoff phases were used to determine the systolic and diastolic blood pressure (DBP), respectively. The sphygmomanometer calibration was constantly assessed. To avoid error in measurements due to physical activity, the participants were told not to exercise before data collection. Heart rate (HR) was measured manually by placing the index and middle finger close to the windpipe of the participants and then counted using a stopwatch (Thomas®, New Jersey, USA).

Exercise intervention

Participants in the treatment group participated, in a supervised vigorous-intensity aerobic exercise training program, which was achieved by jogging for 30 min/day, at an estimated intensity of 6.32 metabolic equivalents (METs), 3 times/week, consistently for 1 year. This was estimated as follows; the mean age of participants in the treatment group was = 42.05 years. By applying Jones equation, estimated maximal oxygen uptake ($VO_{2\ max}$) in METs = (60–0.55 × 42.05)/3.5 = 10.54 METs. Vigorous-intensity activity criterion = $VO_{2\ max}$ in METs = (0.60 × 10.54 METs) = 6.32 METs. METs per week = (6.32 METs × 3) = 18.96 METs·per week.[19]

Sample size

The sample size for this study was calculated using this mathematical formulae

$$N = \frac{(Z\Omega)^2 \mathrm{Pq}}{\beta^2}$$

where N = Sample size, Z = Coefficient of standard normal deviate (usually express at 1.96 for 95% confidence interval), P = Sample proportion, $q = 1 - p$. β = sampling error (it was considered for this to be within 5% of its actual parameter with 95% confidence), the proportion (p) of individuals that were addicted to sports betting in Lagos State, Nigeria was estimated at 0.6.

$$N = \frac{1.96 \times 1.96 \times 0.6 \times 0.4}{0.05 \times 0.05} N = 368.$$

A sample size of 368 was used for this study.

Inclusion criteria

Individuals residing in Lagos State, Nigeria, aged between 35 and 55 years and were active bettors (both offline and online sports bettors), BMI ≥23 kg/m^2, WC >94 cm, and weight stable (<5% weight loss or gain) for 3 months before the beginning of the study, were enrolled for this study.

Exclusion criteria

Individual who reported any severe cardiovascular disease, psychiatric disorder, renal disease, and respiratory disease were excluded from the study.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki 1964 as revised in 2000. This was a community health development project (CD) conducted for 1 year under the National Youth Service Corps scheme in Lagos State,

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Table 1: Cardiovascular health parameters of subjects in the control group

Items	Age range	Frequency (%)	χ^2	*P*
Age (years)	35-40	44 (44.0)	1.204	0.780
	41-46	28 (28.0)		
	47-52	15 (15.0)		
	53 and above	13 (13.0)		
	Total	100 (100.0)		
BMI (kg)	Normal weight (18.5-24.9)	43 (43.0)	0.636	0.909
	Overweight (25.0-29.9)	22 (22.0)		
	Class 1 obesity (30.0-34.9)	24 (24.0)		
	Class 2 obesity (35.0-39.9)	11 (11.0)		
	Total	100 (100.0)		
SBP	Normal (<120 mmHg)	14 (14.0)	3.226	0.382
	Prehypertension (120-139)	53 (53.0)		
	Hypertension Stage 1 (140-159)	25 (25.0)		
	Hypertension Stage 2 (>160 and above)	8 (8.0)		
	Total	100 (100.0)		
DBP	Normal (<80 mmHg)	22 (22.0)	7.559	0.022
	Prehypertension (80-89)	40 (40.0)		
	Hypertension Stage 1 (90-99)	22 (22.0)		
	Hypertension Stage 2 (100 and above)	16 (16.0)		
	Total	100 (100.0)		
HR	<75 (bpm)	45 (45.0)	1.625	0.481
	75-80	34 (34.0)		
	81 and above	21 (21.0)		
	Total	100 (100.0)		
WC (cm)	Increase (<102)	89 (89.0)	14.754	0.000
	Substantially increase (>102)	11 (11.0)		
	Total	100 (100.0)		

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, WC: Waist circumference

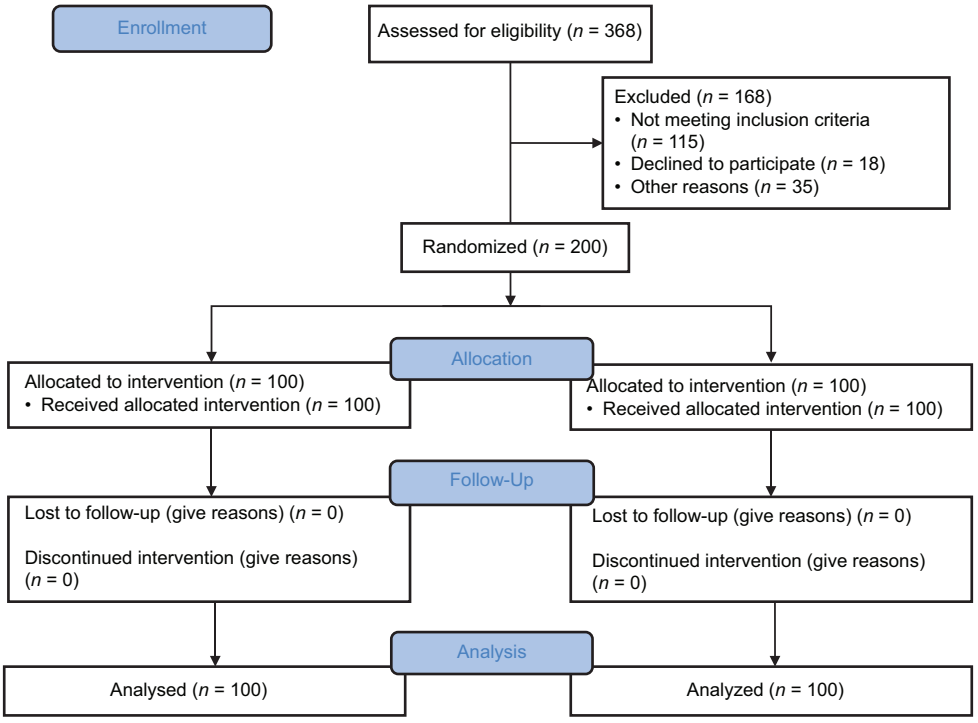

Figure 1: Consort flow diagram

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Table 2: Cardiovascular health parameters of subjects in the treatment group

Items	Age range	Frequency (%)	χ^2	*P*
Age (years)	35-40	51 (51.0)	5.310	0.158
	41-46	24 (24.0)		
	47-52	12 (12.0)		
	53 and above	13 (13.0)		
	Total	100 (100.0)		
BMI (kg)	BMI class		5.091	0.078
	Normal weight (18.5-24.9)	52 (52.0)		
	Overweight (25.0-29.9)	25 (25.0)		
	Class one obesity (30.0-34.9)	23 (23.0)		
	Total	100 (100.0)		
SBP	Normal (<120 mmHg)	11 (11.0)	4.727	0.199
	Prehypertension (120-139)	56 (56.0)		
	Hypertension, Stage 1 (140-159)	27 (27.0)		
	Hypertension Stage 2 (>160 and above)	6 (6.0)		
	Total	100 (100.0)		
DBP	Normal (<80 mmHg)	22 (22.0)	2.000	0.606
	Prehypertension (80-89)	42 (42.0)		
	Hypertension Stage 1 (90-99)	27 (27.0)		
	Hypertension Stage 2 (100 and above)	9 (9.0)		
	Total	100 (100.0)		
HR	<75 (bpm)	46 (46.0)	1.120	0.611
	75-80	38 (38.0)		
	81 and above	16 (16.0)		
	Total	100 (100.0)		
WC	Increase (<102 cm)	100 (100.0)		

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, WC: Waist circumference

Nigeria, from 2016 to 2017 (LA/NUA/2016/026620). Ethical approval was obtained from the national committee. Informed written consent was filled and signed by all the participants, to ensure the protection of participants' privacy and data.

Statistical analysis

Data regarding BMI, systolic blood pressure (SBP), DBP, HR, and WC were collected and analyzed before and after the intervention. The data collected before and after the trial was analyzed using one-way analysis of variance (ANOVA) test, a significant difference was determined at the level of $P < 0.05$ using the SPSS software package version 20 (IBM Corp. Version 20.0, Armonk, NY, USA). Dependent paired *t*-test was used to compare the results within the groups.

Results

The mean age of all the participants was 42.43 ± 0.65 years. The mean age of participants assigned to the control group was 42.80 ± 0.64 years, while that of participants assigned to the treatment group was 42.05 ± 0.65 years. There was no significant difference between the mean age of participants in the control group and treatment group. When the cardiovascular health parameters of participants in the control group and treatment group were compared before 1 year regular exercise intervention, the results from the analysis revealed no significant difference in their mean ages (control: 42.80 ± 0.64, treatment: 42.05 ± 0.65, $P > 0.414$), BMI (control: 27.18 ± 0.52, treatment: 25.85 ± 0.50, $P > 0.072$), SBP (control: 134.35 ± 1.63, treatment: 133.37 ± 1.49, $P > 0.659$), DBP (control: 89.18 ± 1.16, treatment: 88.15 ± 1.08, $P > 0.519$), and HR (control: 76.85 ± 0.70, treatment: 75.67 ± 0.51, $P > 0.179$). However, there was a significant difference when their WC (control: 91.14 ± 0.78, treatment: 88.79 ± 0.63, $P > 0.020$) was compared [Table 3].

The results from the ANOVA comparison of the cardiovascular health parameters of participants in the control group and treatment group after 1-year regular exercise intervention was statistically significant, when the mean BMI (control: 27.18 ± 0.52, treatment: 21.73 ± 0.30, $P > 0.000$), SBP (control: 134.35 ± 1.63, treatment: 110.69 ± 1.11, $P > 0.000$), DBP (control: 89.18 ± 1.16, treatment: 77.14 ± 0.52, $P > 0.000$), HR (control: 76.85 ± 0.70, treatment: 72.06 ± 0.25, $P > 0.000$), and WC (control: 91.14 ± 0.78, treatment: 86.26 ± 0.41, $P > 0.000$) of participants in the treatment group were compared with the control group, there was a significant improvement. However, there was no significant difference in the mean age (control: 42.80 ± 0.64, treatment: 42.05 ± 0.65, $P > 0.641$) between the control group and treatment group [Table 4]. From the results of ANOVA, comparison of some cardiovascular health parameters of participants in the control group and treatment group before and after 1-year regular exercise intervention, the composite chart [Figure 2], shows a statistical significant difference in

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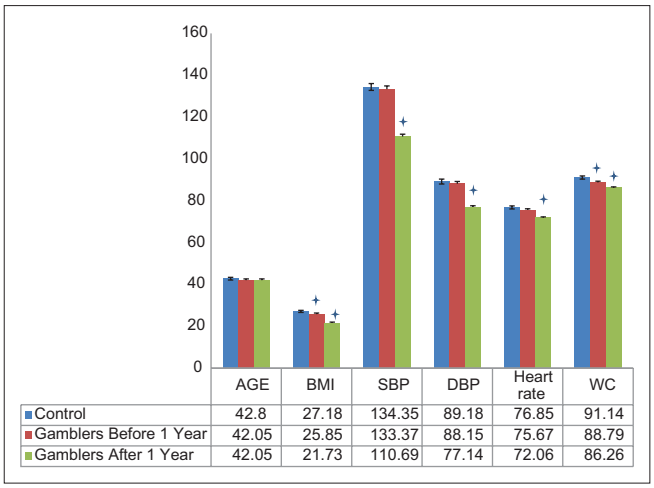

Figure 2: Comparison of the cardiovascular health parameters of subjects in the control group and treatment group before and after 1-year exercise intervention. +Represent the significant difference when the treatment group is compared with the control group at the level of $P < 0.05$. AGE: Participants ages, BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, WC: Waist Circumference

Table 3: Comparison of the cardiovascular health parameters of subjects in the control group and treatment group before 1 year regular exercise intervention

Parameters	Mean±SEM		*P*	*t*
	Control	Treatment group before 1 year exercise		
Age	42.80±0.64	42.05±0.65	0.414	0.818
BMI	27.18±0.52	25.85±0.50	0.072	1.806
WC	91.14±0.78	88.79±0.63	0.020	2.337
SBP	134.35±1.63	133.37±1.49	0.659	0.442
DBP	89.18±1.16	88.15±1.08	0.519	0.646
HR	76.85±0.70	75.67±0.51	0.179	1.350

BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, WC: Waist circumference, SEM: Standard error of the mean

the cardiovascular health parameters (BMI, SBP, DBP, HR, and WC) between the control group and treatment group after 1-year exercise intervention, indicating improvements in the parameters of cardiovascular health among participants in the treatment group.

Discussion

There is a rise in sports gambling activities in Lagos State, Nigeria, especially among the uneducated and unemployed youths in the state.[20] Problem gambling was associated with anxiety, depression, substance abuse, suicide ideation, and financial difficulties in the United Kingdom.[21]

Mohammadkhani *et al*. found that the consumption of 50 mg of caraway per kilogram of body weight daily combined with aerobic exercise (3 sessions per week at an intensity of 65%–70% maximum HR) among obese women for 8 weeks, caused significant improvements in waist-hip ratio, percentage of body fat, and there was a statistical significant decrease in the level of C-reactive protein (CRP) and improvement in sleep quality among subjects in the combined supplement and exercise group when compared to the control group.[22] This result described the beneficial role of aerobic exercise training in lifestyle intervention and in the decrease of cardiovascular risk, which could be more effective if combined with supplements or diets.

Irandoust and Taheri conducted an experimental study on the effects of water-based exercises on inflammatory markers with regard to cardiovascular health, they analyzed the activities of homocysteine, CRP, and fibrinogen in 28 obese women, they carried out a combined resistance, stretching, and balance exercise program, 3 sessions/week in the surface end of the pool for 10 weeks; however at the end of the experiment, they discovered significant improvements in CRP, fibrinogen, and homocysteine indices among obese women that participated in the 10 weeks combined water-based exercise training; moreover, there were significant reductions in body fat percentage, cholesterol, and SBP.[23] These results further support the argument that regular physical activity is effective

Table 4: Analysis of variance comparison of the cardiovascular health parameters of subjects in the control group and treatment group after 1 year of exercise

	Mean±SEM			*P**	*F*
	Control	Treatment			
		Subjects before 1 year regular exercise intervention	Subject after 1 year regular exercise intervention		
Age	42.80±0.64	42.05±0.65	42.05±0.65	0.641	0.445
BMI	27.18±0.52	25.85±0.50	21.73±0.30	0.000	38.273
SBP	134.35±1.63	133.37±1.49	110.69±1.11	0.000	87.317
DBP	89.18±1.16	88.15±1.08	77.14±0.52	0.000	47.401
HR	76.85±0.70	75.67±0.51	72.06±0.25	0.000	22.579
WC	91.14±0.78	88.79±0.63	86.26±0.41	0.000	15.124

*The mean difference is statistically significant at the level of $P < 0.05$. BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, HR: Heart rate, WC: Waist circumference, SEM: Standard error of the mean

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in minimizing cardiovascular risk factors, thus causing significant improvements in cardiometabolic health.

Exercise was effective as an adjunct therapy for individuals suffering from alcohol use disorder.[24] However, there are few scientific information on the effects of exercise on cardiovascular health among problem gamblers. Exercise program resulted in a significant decrease in psychiatric comorbidities associated with problem gambling.[25] Apart from the role of exercise in improving cardiovascular health among problem gamblers as proven by this study, mind-body exercises can be an effective therapy for the treatment of substance use disorders among problem gamblers.[26] There was a decrease in gambling craving among pathological gamblers, after participating in an exercise program.[27] Problem gamblers are predisposed to high blood pressure, angina, and tachycardia.[28] Exercise might be an effective therapy in addition to psychotherapeutic treatment of gambling disorder, because exercise improves cardiovascular health, reduces the craving to gamble and minimizes the symptoms of anxiety and depression.[29]

The result of the ANOVA comparison of the cardiovascular health parameters between the control group and treatment group after 1 year exercise intervention [Table 4], shows statistically significant improvements in BMI (control: 27.18 ± 0.52, treatment: 21.73 ± 0.30, $P > 0.000$), SBP (control: 134.35 ± 1.63, treatment: 110.69 ± 1.11, $P > 0.000$), DBP (control: 89.18 ± 1.16, treatment: 77.14 ± 0.52, $P > 0.000$), HR (control: 76.85 ± 0.70, treatment: 72.06 ± 0.25, $P > 0.000$), and WC (control: 91.14 ± 0.78, treatment: 86.26 ± 0.41, $P > 0.000$) among participants in the treatment group, this was in line with the findings of Mohammadkhani *et al*.,[22] Irandoust and Taheri,[23] and Salas *et al*.,[30] They discovered that being physically active modifies the detrimental effects of sedentary behaviors on cardio-metabolic and obesity-related traits.

Exercise improves the level of dopamine in adults, which could go also long way to minimize gambling cravings, impulsivity, and other addictive behaviors.[31] There is a need to incorporate an exercise-training program as part of the pharmacological and psychotherapeutic treatment of gambling disorder and associated psychiatric comorbidities because of the beneficial effects of regular physical exercise on the cardiovascular and mental health in healthy individuals and psychiatric patients.[31]

Limitations

The limitations of this study were the inability to carry out a blinded randomized controlled trial due to the nature of the exercise intervention program, and cardio-metabolic tests such as the analysis of the level of low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and triglycerides were not utilized.

Conclusion

The findings from this study shows that male problem gamblers that participated in a supervised vigorous-intensity aerobic exercise training program which was achieved by jogging for 30 min/day, at an estimated intensity of 6.32 METs, 3 times/week, consistently for 1 year, had a statistically significant decrease in BMI, SBP, DBP, HR, and WC.

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Conflicts of interest

There are no conflicts of interest.

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