

Original Research Article

Blood pressure and intra-ocular pressure in a sample of young professional footballers in Benin City, Nigeria

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ABSTRACT

Background: Some studies have demonstrated that football players may be at risk for clinically relevant increases in blood pressure (BP). BP is often associated with intraocular pressure (IOP). However, there is scarce literature on BP and IOP in football athletes. The aim of this investigation was therefore to study BP and IOP in young professional footballers and non-athletes.

Methods: A cross-sectional study was conducted among nineteen (19) professional male football athletes of 18-28 years old; and nineteen (19) matched controls who were not active in any sports. All measurements were taken between 3 pm and 6 pm to lessen the effects of diurnal variations on IOP. Case history was first carried out to ascertain if the subjects were suitable for the study. Non-athletic subjects were matched with athletes according to sex, age, body mass index and random blood sugar. BP was measured in the right arm of each subject in sitting position with a mercury sphygmomanometer. IOP was measured in both eyes with a Schiotz tonometer.

Results: Compared to non-athletes, the professional football athletes had significantly higher mean systolic BP ($p=0.003$), diastolic BP ($p=0.030$) and IOP ($p=0.036$). There was no correlation between IOP and systolic or diastolic BP in the football athletes ($p>0.05$).

Conclusions: The young professional footballers were more predisposed to high blood pressure and ocular hypertension than the matched controls.

Keywords: Young professional footballers, Non-athletes, Blood pressure, Intra-ocular pressure

INTRODUCTION

Several studies have demonstrated that football players may be at risk for clinically relevant increases in BP and the development of hypertension.¹⁻³ Some studies have also shown high prevalence of pre-hypertension and hypertension in football athletes and indicated that the players may be at increased risks of cardiovascular diseases such as myocardial infarction, stroke, arrhythmias, and heart failure.^{2-5,9}

Increased intraocular (IOP) is often associated with raised BP.¹⁰⁻¹⁵ High BP is thought to increase IOP through two major processes: First, by increasing blood circulation to

the ciliary body, causing increased ultrafiltration at the ciliary epithelium and increased aqueous production.^{10,11,13-15} Second, by reducing the ease of aqueous drainage across the trabecular meshwork, due to raised episcleral venous pressure.¹⁰⁻¹⁵ Increased IOP, if unchecked, can lead to glaucomatous optic neuropathy and irreversible deterioration of vision.^{10,12-16}

Although studies have shown that IOP levels are often associated with systemic BP, and footballers may be at risk of high BP, there is scarce literature on BP and IOP in youthful football athletes.^{1-5,10-15} The aim of this investigation was therefore to study BP and IOP in young professional footballers and non-athletes.

The objectives were to (i) compare BP in young football athletes and non-athletes; (ii) compare IOP in football athletes and non-athletes; and (iii) explore any relationship between BP and IOP in the professional football athletes.

METHODS

A cross-sectional study was conducted in December 2018, among nineteen (19) professional male footballers of 18-28 years old, whose primary occupation was football; and nineteen (19) non-athletic controls who were not active in any sports. The football athletes were enrolled via convenience sampling from a prominent football club in Benin City, Nigeria. The matched controls were selected by purposive sampling from the university of Benin, Benin City. The purpose and procedure of the study were explained to each subject and informed consent was taken. Data were collected from the football athletes at their training camp located in Benin City; and from the controls at the department of optometry, university of Benin, Benin City. All measurements were taken between 3 pm and 6pm to lessen the effects of diurnal variations on IOP. This time was also when the athletes had quite rested, in-order-to rule out any potential effects of exercise.

Case history was first carried out to ascertain if the subjects were suitable for the study. Records about age, use of drugs, drinking, smoking, and ocular and systemic histories were also obtained. Physical measurements were done by standardized methods. Visual acuity was measured for each eye with the Snellen chart. Height was measured in centimeters without foot wear using a measuring tape. Weight was measured to the nearest 100 kg with the use of a digital weighing scale. BMI was derived by Quetelet index ($\text{Bodyweight}/\text{height}^2$). Random blood sugar (RBS) test was carried out with an Accu blood glucose reader (Accu-check active, mg/dl, Lot: 06067445; REF: 07133766200; Ser. No. GB 11560708; NAFDAC Reg. No. 03-0551; made in Germany) which gave results in mg/dl. Non-athletic subjects were matched with athletes according to sex, age, BMI and RBS. BP was measured in the right arm of each subject in sitting position with a mercury sphygmomanometer (Medifield equipment and scientific L.T.D, CE 0197). After ophthalmoscopy, intraocular pressure was measured on both eyes using a Schiottz tonometer (Riester, No. 5113schiotz C).^{10,16} Statistical analysis was performed using SPSS version 21. Unpaired t test was used to compare the following between the football athletes and non-athletes to confirm that there was no significant difference ($p>0.05$): age, BMI and RBS. The mean BP and IOP of the professional football athletes were then compared with the non-athletes' using the unpaired t test. Pearson's correlation was used to test for correlation between IOP and other study parameters (age, BMI, RBS and BP). All parameters were expressed as Mean \pm SD (standard deviation). P value was taken significantly at 5% confidence level ($p<0.05$).

RESULTS

There was no significant difference between the athletes and non-athletes with regard to age ($p=0.40$), BMI ($p=0.16$) or RBS ($p=0.17$). The mean and standard deviation (SD) for each variable is shown in Table 1; the minimum and maximum values are depicted in Table 2. The unaided visual acuities of both groups ranged from 6/9 to 6/5. Of the football athletes, 12 (64.71%) said they took alcohol occasionally, while 1 (5.88%) confessed to drinking a lot. None of footballers said they smoked. Of non-athletes, 9 (47.37%) said drank alcohol occasionally, while none confessed to drinking beer a lot or smoking.

Compared to the non-athletes, the professional football athletes had significantly higher systolic BP ($p=0.003$), diastolic BP ($p=0.030$) and IOP ($p=0.036$). The mean and standard deviation (SD) for each parameter are included in Table 1. The minimum and maximum values are depicted in Table 2. There was no significant correlation between IOP and systolic or diastolic BP ($p>0.05$) in the football athletes or non-athletes. No correlation was also observed between the following in either the athletes or the non-athletes ($p>0.05$): age and IOP; BMI and IOP; and RBS and IOP.

Table 1: Mean, standard deviation (SD) and p value for age, BMI, RBS, systolic BP, diastolic BP and IOP of the footballers and non-athletes.

Parameter	Football athletes (Mean \pm SD)	Non-athletes (Mean \pm SD)	P value
Age (years)	22.39 \pm 3.70	23.84 \pm 2.95	0.403
BMI (kg/m ²)	23.44 \pm 1.93	22.41 \pm 2.66	0.157
RBS (mg/dl)	96.47 \pm 13.27	101.6 \pm 19.28	0.173
Systolic BP (mmHg)	127.41 \pm 7.27	121.37 \pm 6.36	0.003
Diastolic BP (mmHg)	82.06 \pm 6.07	77.84 \pm 4.79	0.030
IOP (mmHg)	26.83 \pm 6.66	23.72 \pm 4.80	0.036

Table 2: Minimum and maximum values for age, BMI, RBS, systolic BP, diastolic BP and IOP of the footballers and non-athletes, (n=19).

Parameter	Football athletes		Non-athletes	
	Min	Max	Min	Max
Age (years)	18	28	19	28
BMI (kg/m ²)	20.2	28.1	18.1	28.1
RBS (mg/dl)	82	139	78	141
Systolic BP (mmHg)	118	144	110	130
Diastolic BP (mmHg)	75	95	70	85
IOP (mmHg)	16.17	35.40	14.6	32.67

DISCUSSION

The findings indicate that the football athletes had a higher mean systolic BP (127 ± 2.27 mmHg) than the non-athletes (121.37 ± 6.36 mmHg), $p=0.003$. The mean diastolic BP of the athletes (82.06 ± 6.07 mmHg) was also significantly higher than that of the non-athletes (77.84 ± 4.79 mmHg) $p=0.030$. The athletes had an average BP in the pre-hypertensive range. Pre-hypertension, a precursor of clinical hypertension, is defined as systolic BP and diastolic BP of 120-139 and 80-89 mmHg, respectively.^{4,10,13,15} The higher BP in the footballers indicates that they were more predisposed to hypertension than the matched controls, which were of similar age, gender, BMI and race. This is related to findings by Karpinos et al, who observed that collegiate male football athletes had higher mean systolic blood pressure and markedly higher prevalence of pre-hypertension and hypertension, than male non-football athletes.⁴ It is also related to a finding by Tucker et al who observed that professional football players had a higher prevalence of hypertension (13.8%) compared with age-matched men in the general US population (5.5%).⁵ The higher prevalence of hypertension in their study persisted even after adjusting for BMI and race.⁵ Regular BP evaluation is therefore important in this population, as uncontrolled hypertension can lead to heart attack, stroke, heart failure, kidney disease, vision loss, sexual dysfunction, angina, peripheral artery disease and sometimes death.⁹ Evaluating BP and managing pre-hypertension in these young athletes can reduce the risks of hypertension and the development of cardiovascular diseases in the future.^{6,5}

One cause of high BP in football athletes is protracted physical activity.^{9,17} High BP risk among athletes can vary extensively, depending on type and concentration of physical activity.¹⁷ Imbalance between training, competition and recuperation can have adverse effects on heart muscles and involuntary cardiovascular control.⁹ Other factors that may lead to high BP in football athletes include psychosocial pressures of matches, long-term use of non-steroidal anti-inflammatory medications, high salt ingestion, stimulant use, supplement use, and/or banned substance use.^{4,5} Though the athletes in our study had quite rested for 2 to 3 hours to rule out any potential effects of exercise, in assessing BP we barely altered the lifestyles of both groups, and did not control these elements. This is probably why our findings are different from those by Gökhan et al, who showed that the mean systolic BP of soccer players was significantly lower than that of the control group.¹⁸ They also found no significant difference in mean diastolic BP between both groups.¹⁸ In their study, all the subjects in both groups were subjected to the same diet program, and not allowed to do any exercise or receive vitamins for three days before the survey.¹⁸

Another finding from our study is that the professional football athletes had a significantly higher mean IOP

(26.83 ± 6.66 mmHg) than the non-athletes (23.72 ± 4.80 mmHg), $p=0.036$. While both mean IOPs were above normal, the greater mean IOP in the young athletes may have been as a result of their higher mean systolic and diastolic BP.¹⁰⁻¹⁵ However, there was no significant correlation between IOP and systolic or diastolic BP ($p>0.05$). This signifies that high BP may not have been solely responsible for the elevated IOP. Other factors such as alcohol abuse, pre-exercise drugs, caffeine ingestion in tea, cola, energy drink, milk chocolate and/or cigarette smoking may have also contributed.^{19,20} For example, our results show that more football athletes (70.59%, $n=13$) said they customarily consumed alcohol than the non-athletes (47.37%, $n=9$). Again, considering the high levels of mental stress athletes undergo during tournaments, anxiety may also have played a role in their higher mean IOP.²¹⁻²³ In any case, increased IOP can engender optic neuropathy and bring about incurable loss of vision.¹⁰⁻¹⁵ Thus regular ophthalmological assessment is also important in this population to check ocular hypertension and glaucoma.

One limitation of this study is that Schiötz tonometry, which is a screening test, was used to assess IOP.¹⁶ When Schiötz tonometry indicates a high IOP, applanation tonometry is usually used to confirm the result before starting appropriate management.¹⁶ Other limitations may include the relatively small sample size of this study, and age fabrication in football.

CONCLUSION

In conclusion, the aim of this investigation was to study BP and IOP in young professional footballers and non-athletes. The results indicate that the football athletes had higher mean BP and IOP ($p<0.05$). This suggests that they were more predisposed to high blood pressure and ocular hypertension than the matched controls. The higher IOP in the players may have been as a result of their higher mean BP.¹⁰⁻¹⁵ However, since there was no significant correlation between IOP and systolic or diastolic BP ($p>0.05$) in the athletes, other factors may have also contributed to their elevated IOP. Regular BP and IOP evaluations are therefore important in this population, to check high blood pressure and ocular hypertension, and their implications.

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