Effects of Wolff-Parkinson-White Pattern on Anthropometric Variables and Blood Pressure Indices among Adult Nigerians of Yoruba Ethnicity

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ABSTRACT

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Aims: This study assessed the effects of the Wolff-Parkinson-White (WPW) pattern on anthropometric parameters and cardiovascular indices.

Study design: This was a descriptive retrospective study.

Place and Duration of Study: This study was carried out in the Department of Physiological Sciences between 2014 and 2016.

Methodology: The printouts of electrocardiogram (ECG obtained from a total of 9,826 young adults (aged 15-40 years) who presented for medical screening were reviewed, analyzed, and classified into two categories: groups A and B. Group A contained ECGs with features of the WPW pattern, while group B contained age- and sex-matched controls. Blood pressure (BP) and heart rate (HR) obtained from each individual using digital BP measurements were recorded for the determination of Pulse Pressure (PP), Mean Arterial Pressure (MAP), and Rate Pressure Product (RPP). The recorded weight and height of the selected cases were obtained for the determination of body mass index (BMI) and body surface area (BSA)using the Quetelet index formula [BMI = (weight (kg)/height (m)$^{2]}$ and the Mosteller equation (BSA = square root of the height (cm) multiplied by the weight (kg) divided by 3600) respectively

Results: The mean SBP (mmHg), DBP (mmHg), HR (bpm), and PP (mmHg) for groups A and B were 118.09±12.54 and 114.82±8.99 (t=2.850, P=.490); 70.64±9.56 and 63.18±8.41 (t=.351, P=.066); 71.73±17.08 and 69.91±14.86 (t=1.951, P=.793); and 47.45±6.64 and 51.64±10.25 (t=2.049, P=0.269) respectively. The mean weight (kg), height (m), BSA (m^2), and BMI for groups A and B were 52.25±7.25 and 57.50±7.59 (t=.196, P=.961); 1.70±0.06 and 1.70±0.09 (t=.713, P=.916); 1.68±0.16 and 1.68±0.15 (t=.083, P=.954); 20.75±2.23 and 20.80±1.74 (t=.362, P=.954) respectively.

Conclusion: The WPW pattern may occur among young adults without significantly altering cardiovascular or anthropometric indices.

Keywords*: Wolff-Parkinson-White Pattern, anthropometry, cardiovascular indices, young adults.*

1. INTRODUCTION

Wolf-Parkinson-White (WPW) pattern is a congenital cardiac disorder characterized by the presence of an accessory pathway known as the bundle of Kent. WPW pattern predisposes individuals to episodes of tachyarrhythmias [1,2]. It constitutes one of the pre-excitation syndromes, with diagnosis primarily reliant upon electrocardiogram (ECG). Characteristic features of the WPW pattern on ECG include a shortened PR interval (<0.120s), delta wave (manifesting as a slurred initial QRS deflection), widened QRS complexes (QRS interval >0.120s), secondary repolarization abnormalities and predisposition to tachycardia [2]. The presence of WPW pattern and palpitation is regarded as WPW syndrome. In the Italian population of young adults, the incidence of WPW syndrome was determined to be 1.68 per 1000 [3]. WPW pattern or syndrome has been described as congenital heart disease more common in males among children and young adult populations [3-6].

While the presence of the Wolff-Parkinson-White pattern generally portends a benign prognosis for patients [7], the impact of this congenital anomaly on anthropometric indices remains underreported. Studies have suggested that individuals with congenital heart diseases may experience growth stunting [8] and reduced BMI [9], though some may maintain normal BMI [10]. Hypertension has been linked with congenital heart diseases [11-13], and tachycardia may also manifest in affected individuals [14]. The severity of certain congenital heart diseases has shown a correlation with various blood pressure indices [15]. Elevated heart rates have been documented among those with congenital heart diseases [16], while individuals with cyanotic congenital heart diseases have been found to exhibit higher rate pressure-product (RPP) compared to controls [17].

In the context of the WPW pattern, the annual risk of potential sudden incapacitation and sudden cardiac death stands at 0.95% and 0.03% respectively. Factors associated with a heightened risk include younger age, lower diastolic blood pressure, reduced total cholesterol levels, and enhanced physical fitness [18]. This study assessed the effects of the WPW pattern on anthropometric parameters, heart rate, and blood pressure indices among young adult Nigerians.

2. MATERIAL AND METHODS

This was a descriptive retrospective study conducted within the Department of Physiological Sciences between 2014 and 2016. The study involved a review of archived copies of ECGs obtained from a total of 9,826 young adults aged 15-40 years who underwent medical screening with an ECG machine (Cardiofax S). These ECGs were analyzed and classified into two groups: A and B. Group A comprised ECGs exhibiting features of the Wolff-Parkinson-White (WPW) pattern. Among the total sample, only 11 ECGs were identified as having features consistent with the WPW pattern, characterized by a short PR interval (<0.12s), broad QRS complex (>0.12s), presence of a delta wave, and absence of a PR segment. Group B consisted of 11 normal ECGs of age- and sex-matched controls also selected from the archive. WPW patterns were classified into two categories based on the occurrence of the WPW beats from the beginning of the recording to the end. The occasional occurrence of WPW beats characterized the intermittent WPW pattern, while the continuous WPW pattern was characterized by the presence of WPW beats throughout the rhythm.

Blood pressure (BP) and pulse rate (PR) figures obtained using a digital BP monitor (OMRON) and recorded on the ECG printouts were extracted. Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) were documented. Pulse pressure (PP), mean arterial pressure (MAP), and rate-pressure product (RPP) were derived from the SBP and DBP. Additionally, the weight and height of individuals in groups A and B obtained using the ZT120 Health scale and recorded alongside the biodata on the ECG printouts were documented. Body mass index (BMI) and body surface area (BSA) were calculated from the weight and height using the Quetelet index formula (BMI = weight (kg) / height $(m)^2$) and the Mosteller equation (BSA = square root of height (cm) multiplied by weight (kg) divided by 3600), respectively. Statistical analysis was performed using the Student's t-test, with a p-value of <.05 considered statistically significant.

3. RESULTS

A total of twenty-two ECGs of young adults were selected for this study. The mean weight (Kg), Height (m), BSA (m^2), and BMI (kg/m^2) of the participants with WPW patterns were compared with the controls without statistically significant differences (Table 1a). The mean systolic blood pressure (mmHg), diastolic blood pressure (mmHg), pulse rate (bpm), pulse pressure (mmHg), rate pressure product, and mean arterial pressure of the participants with WPW pattern were compared with control (Table 1b). All the cardiovascular variables except the pulse pressure were higher among the individuals with WPW patterns but the differences were not statistically significant. The anthropometric parameters and blood pressure indices of participants with continuous WPW patterns were compared with an equal number of controls who were aged- and sex-matched as shown in Tables 2a and 2b. There were no significant statistical differences in the variables. The anthropometric parameters and blood pressure indices of participants with intermittent WPW patterns were also compared with an equal number of controls who were aged- and sex-matched (Tables 3a and 3b). No significant statistical difference was found.

Table 1a: Anthropometric Parameters Indices of Wolff-Parkinson-White Pattern and Control Groups

Variables	Mean± SD of Anthropometric Parameters		t	p-value
	WPWP (n=11)	Control (n=11)		
Age (years)	22.27 ± 2.37	22.27 ± 2.37	0.000	1.000
Weight (kg)	52.25 ± 7.27	57.50 ± 7.59	0.196	0.961
Height (m)	1.70 ± 0.06	1.70 ± 0.09	0.713	0.916
BSA (m^2)	1.68 ± 0.16	1.68 ± 0.15	0.083	0.964
BMI (kg/m^2)	20.75 ± 2.23	20.80 ± 1.74	0.362	0.954

WPWP- Wolff -Parkinson-White Pattern, BSA- Body surface area, BMI- Body mass index

Table 1b: Blood Pressure and Pulse Rate Indices of Wolff-Parkinson-White Pattern and Control Groups

Variables	Mean± SD of Blood Pressure and Pulse Rate Indices		t	p-value
	WPWP (n=11)	Control (n=11)		
SBP (mmHg)	118.09 ± 12.54	114.82 ± 8.99	2.850	0.490
DBP (mmHg)	70.64 ± 9.56	63.18 ± 8.41	0.351	0.066
PR(beats/min)	71.73 ± 17.08	69.91 ± 14.86	1.951	0.793
PP (mmHg)	47.45 ± 6.64	51.64 ± 10.25	2.049	0.269
RPP	8503.27 ± 2350.09	7982.45 ± 1591.57	2.416	0.550
MAP (mmHg)	86.45 ± 10.18	80.39 ± 7.04	3.034	0.120

*- Statistically significant ($p < 0.05$), WPWP- Wolff-Parkinson-White Pattern, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure, PR- Pulse Rate, PP- Pulse Pressure, RPP- Rate pressure product, MAP- Mean arterial pressure.

Table 2a: Anthropometric Parameters in Continuous Wolff-Parkinson-White Pattern and Control Groups

Variables	Mean± SD of Anthropometric Parameters			
	CWPWP (n=7)	Control (n=7)	t	p-value
Weight (kg)	64.86 ± 6.74	61.57 ± 8.50	0.801	0.439
Height (cm)	172.42 ± 6.83	172.42 ± 7.37	0.000	1.000
BSA (m^2)	1.76 ± 0.12	1.72 ± 1.55	0.616	0.550
BMI (kg/m^2)	21.76 ± 1.08	20.61 ± 1.64	1.554	0.146

CWPWP- Continuous Wolff- Parkinson -White Pattern, BSA- Body surface area, BMI- Body mass index

Table 2b: Heart Rate and Blood Pressure Indices and Stable Wolff-Parkinson-White Pattern and Control Groups

Variables	Mean± SD of Blood Pressure and Heart Rate Indices		t	p-value
	SWPWP (n=7)	Control (n=7)		
SBP (mmHg)	117.00 ± 14.61	116.00 ± 7.77	0.163	0.874
DBP (mmHg)	69.43 ± 8.22	64.71 ± 6.78	1.171	0.264
PR(beats/min)	63.29 ± 15.37	63.00 ± 9.13	0.042	0.967
PP (mmHg)	47.57 ± 8.36	51.29 ± 8.38	-0.830	0.423
RPP	7422.43 ± 2114.10	7296.86 ± 1125.50	0.139	0.892
MAP	85.29 ± 9.89	81.76 ± 5.83	0.812	0.432

*- Statistically significant ($p < 0.05$), SWPWP- Stable Wolff-Parkinson-White Pattern, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure, HR- Heart rate, PP- Pulse pressure, RPP- Rate pressure product, MAP- Mean arterial pressure.

Table 3a: Comparison of Anthropometric Parameters Indices in Intermittent Wolff Parkinson White Pattern and Control Groups

Variables	Mean± SD of Anthropometric Parameters		t	p-value
	IWPWP (n=4)	Control (n=4)		
Weight (kg)	52.25 ± 7.27	57.50 ± 7.59	-0.998	0.357
Height (cm)	166.00 ± 3.92	165.00 ± 11.22	0.168	0.872
BSA (m^2)	1.55 ± 0.11	1.62 ± 0.15	-0.776	0.467
BMI (kg/m^2)	18.98 ± 2.76	21.13 ± 2.12	-1.236	0.263

IWPWP- Intermittent Wolff -Parkinson-White Pattern, BSA- Body surface area, BMI- Body mass index

Table 3b: Comparison of Blood Pressure and Heart Rate Indices in Intermittent Wolff-Parkinson-White Pattern and Control Groups

Variables	Mean ± SD of Blood Pressure and Heart Rate Indices		t	p-value
	IWPWP (n=4)	Control (n=4)		
SBP (mmHg)	120.00 ± 10.36	112.75 ± 11.82	0.923	0.392
DBP (mmHg)	72.75 ± 12.66	60.50 ± 11.36	1.441	0.200
HR (beats/min)	86.50 ± 6.56	82.00 ± 16.21	0.515	0.625
PP (mmHg)	47.25 ± 2.63	52.25 ± 14.45	-0.681	0.521
RPP	10394.75 ± 1405.30	9182.25 ± 1701.17	1.099	0.314
MAP	88.50 ± 11.88	78.00 ± 9.24	1.395	0.212

*- Statistically significant ($p < 0.05$), IWPWP- Intermittent Wolff Parkinson White Pattern, SBP- Systolic Blood Pressure, DBP- Diastolic Blood Pressure, HR- Heart rate, PP- Pulse pressure, RPP- Rate pressure product, MAP- Mean arterial pressure.

4. DISCUSSION

The average age of both patients and controls in this study was 22.27±2.37 years, which was lower than the mean age reported by Maciel et al [7] in a study involving individuals with the Wolff-Parkinson-White (WPW) pattern. The difference in mean ages could be attributed to variations in the age groups studied. While the reported weight, height, and body mass index (BMI) were higher in the control group compared to the patients, these differences were not statistically significant. This contrasts with Egbe et al[8] study, where patients with congenital heart disease exhibited a significant alteration in weight.

Barton et al [9] reported lower BMI in patients with congenital heart diseases. At the same time, Contrary to the findings of Sandberg *et al* [10] with documentation of a lower body mass index among children with congenital heart disease, the present study did not find any significant difference between the height, weight, and body mass index of the group with Wolff-Parkinson-White pattern and the normal controls. This implied that the Wolff-Parkinson-White pattern, though a potentially deadly heart condition did not significantly alter body growth.

Systolic blood pressure, diastolic blood pressure, heart rate, rate-pressure product, and mean arterial pressure were all higher in the patient group, but these differences were not statistically significant compared to the control group. A few congenital heart diseases such as coarctation of the aorta had been linked with secondary hypertension [11], while Daniel *et al* [12] also described systemic hypertension in patients with Williams syndrome. Tomoaki et al [13] reported a higher incidence of systemic hypertension in adults with congenital heart disease, especially those with a high body mass index.

There was no statistically significant difference in diastolic blood pressure between the control and patient groups. Bin-Nun *et al* [14] reported a correlation between low diastolic pressure, pulse pressure, and the severity of patency in patent ductus arteriosus (PDA). It has also been observed that congenital heart disease was closely associated with elevation of mean arterial pressure and systolic hypertension [15]. This may in part be explained by poor renal perfusion and resultant activation of the renin-angiotensin-aldosterone system. In this present study, the heart rate of patients was higher than that of the control group, though this difference was not statistically significant. However, the Wolff-Parkinson-White pattern predisposes to tachyarrhythmia due to the presence of an accessory pathway. In a stable state, the resting heart rate may remain within the reference range. Wu et al [16] reported supraventricular tachycardia in patients with congenital heart disease, which contrasts with the findings in this study where patients only had the Wolff-Parkinson-White pattern.

The rate-pressure product was higher in the patient group, but the difference was not statistically significant. Similarly, Brunken et al [17] reported a higher rate-pressure product in patients with cyanotic congenital heart disease compared to controls.

The mean arterial pressure was higher in the patient group, but the difference was not statistically significant. Cristina Vega–Barrera et al [15] reported lower mean arterial pressure in patients with congenital heart disease and widened pulse pressure in those with PDA. Although the WPW pattern may occur without significant symptoms, especially in the younger age group with lower diastolic blood pressure and improved physical fitness, it may still pose a significant cardiovascular risk [18]. Therefore, mass screening of healthy young adults with electrocardiograms (ECG) is useful in the community.

5. CONCLUSION

Wolff-Parkinson-White patterns are a potentially dangerous congenital heart disease that may exist without symptoms or significant alteration of anthropometric and blood pressure indices.

ETHICAL APPROVAL

All authors hereby declare that all experiments during data collection have been examined and approved by the appropriate ethics committee and have therefore been performed following the ethical standards laid down in the 1964 Declaration of Helsinki.

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