The Effect of Marital Status and Self-Reported Physical Exercise on the Adiposity and Blood Pressure of the Igbos of Nigeria

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(Received 24 December 2007 and accepted 18 May 2008)

ABSTRACT: The effect of marital status and self-reported exercise was investigated in a sample of Igbos in Nigeria. Physical activity level was grouped into: no exercise, irregular exercise and regular exercise. In all the groups, adiposity level and mean BP decreases as the frequencies of physical activity increases and these were significant for weight, BMI, diastolic BP, body circumferences, skinfold thickness except CSF among the married men, while for the never married men significant difference exist only for WC, FAC, SSF among the three groups. For the married women, the three groups of physical activity recorded significant difference in Weight, BMI, WC and HC while the never married women had significant difference only in CSF ($F = 4.5$, $P = 0.01$). The result of this study suggests that sex, marital status and exercise have effect on adiposity and blood pressure of the subjects. The married state was conducive for the development of excess adiposity and elevated BP while regular participation in exercise brings a reduction in fat stores and blood pressure. In conclusion, there is a greater tendency for married individuals to be overweight as compared to the never married subjects and regular physical exercise has strong influence in reducing the propensity to increase weight in both men and women.

KEY WORDS: Adiposity; Blood Pressure; Physical Exercise; Marital Status; Igbos; Nigeria

INTRODUCTION

Physical inactivity has become a major public hazard[1,2]. Epidemiological and experimental studies over the past 50 years convincingly show that physical inactivity contributes substantially to morbidity and mortality[3,4,5]. In males low-frequency regular physical training activities were associated with lower body fat than that present in sedentary males[1].

Elevated Blood pressure is associated within increased risk of cardiovascular disease, and this process may begin early in life[5,6]. Population based studies[7,8, 9] from the United States have suggested that the risk of death associated with low cardiorespiratory fitness or physical inactivity is comparable with that of conventional CAD risk factors, including tobacco abuse, hypertension, obesity and diabetes mellitus with the most striking differences in overall mortality rates observed when exercise capacity increased from a very low level to the next lowest level in otherwise healthy subjects.

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This study was conducted to evaluate the effect of marital status and self-reported physical exercise on the adiposity and blood pressure of the Igbo ethnic groups in Nigeria.

MATERIAL AND METHOD

Subjects: This study was based on a cross-sectional sample of 534 subjects (309 male and 235 female) from 18 to 78 years of the Igbo ethnic group of Nigeria. Before taking any anthropometric and blood pressure (BP) measurements, participants were contacted in writing through school heads, community leaders and by personal contact and the importance of the study was explained to them. After receiving their informed consent, measurements were taken at the subjects' schools or homes. Based on self reported frequency of physical exercise three groups were identified: those who never exercise (this includes sedentary and those who do not make out time for any form of exercise); those who exercise irregularly and those who exercise regularly (with walking, jogging, bicycling, sports such as basketball, soccer etc).

Anthropometry: Measurements were taken following standardized protocols[10]. Height was measured to the nearest 0.1cm using an anthropometer with subjects standing without shoes and with heels held together, toes apart, and the head held in the Frankfort plane. Weight was measured with a balance scale to the nearest 0.1kg with subjects wearing light clothes. An inelastic tape was used to measure hip, waist, thigh, arm and forearm circumferences. For hip circumference, the tape was placed around the buttocks in a horizontal plane at the level of maximum protrusion of the buttocks. Waist circumference was measured at the level of the natural waist, which is the narrowest part of the torso below the ribcage and above the hips. Thigh, arm and forearm circumferences were taken at the midpoint of the thigh, arm and forearm respectively. Waist-hip ratio (WHR) was calculated thus, waist (cm)/hip (cm)

Skinfold thickness was measured on the subject's body at three sites (triceps, sub scapula and calf regions) by using skinfold caliper. The triceps skinfold was measured in midline of the posterior aspect of the arm over the triceps muscle midway between the lateral projection of acromion process of the scapula and the inferior margin of the ulnar olecranon process. The subscapular skinfold (SSF) was taken beneath the inferior angle of the scapula. Calf skinfold thickness was measured in the midline over the skin covering the calf muscle at the level of maximum protrusion. In these cases a double thickness of skin and underlying tissue were raised and measured.

Blood Pressure (BP): Blood pressure measurements were carried out using aneroid sphygmomanometer and Littman stethoscope to nearest 0.1mmHg. Seated BP was measured with the cuff on the right arm of the subject. The stethoscope was used to establish systole as the initiation of Korotkov sounds (phase I) and diastole as the cessation of Korotkov sound (phase 5). Blood pressure was measured three times with the cuff completely deflated and recovery allowed between readings. The average of the three was used as the systolic and diastolic blood pressure as described by **Al-Kandari et al**[11].

Statistical Analyses: The data were expressed as mean ± standard deviation (SD). Analysis of variance was used to detect significant differences among the three groups of self-reported physical exercise. The alpha level was set at $P < 0.05$. Statistical analyses were carried out using SigmaStat 2.0 for Windows (Systat Inc., Point Richmond, CA).

RESULTS

Table 1 presents the variables indicating adiposity and BP in the overall population of men according to the three groups of exercises defined in the study. All the variables showed a consistent pattern of decrease from No Exercise group to the Regular Exercise group with significant differences ($P<0.05$, 0.01, and 0.001), except for height, thigh circumference and calf skinfold thickness. In men, considering the age it seems that the people who tend to be physically active are the younger.

A different result was obtained for the overall population of women (**Table 2**). The pattern of reduction in anthropometric and blood pressure means seen in men is also seen in the women but not very clearly. In all, the variables none of the differences were statistically significant in the three groups of physical exercises.

Table 1: The anthropometric characteristics of Igbo men according to their level of exercise

Variables	No exercise (n=140)	Irregular exercise (n=114)	Regular exercise (n=55)	F	P
Age (years)	36.33 ±2.42[a]	30.83 ±2.90[b]	29.31 ±1.21[b]	6.64	<0.001
Height (cm)	170.42 ±7.97	170.63 ±7.81	172.17 ±6.78	0.73	0.54
Weight (kg)	73.06 ±4.51[a]	67.65 ±0.89[b]	68.44 ±0.74[b]	4.33	0.005
BMI (kg/m^2)	25.21 ±4.9[a]	23.15 ±2.76[b]	22.99 ±2.68[b]	7.8	<0.001
Systolic BP (mmHg)	125.33 ±24.12[a]	118.11±20.41[b]	117.13±20.30[b]	3.13	0.03
Diastolic BP (mmHg)	84.04 ± 12.13[a]	78.92 ± 13.42[b]	80.21 ± 10.13[b]	4.26	0.006
Waist circumference (cm)	85.28 ± 10.11[a]	79.30 ±8.46[b]	77.90 ±5.68[b]	14.30	<0.001
Hip circumference (cm)	95.35 ±9.92[a]	92.03 ±6.66[b]	90.82 ±6.85[b]	5.64	<0.001
Arm circumference (cm)	29.95 ±3.07	28.93 ±2.82	28.18 ±2.27	5.95	<0.001
Forearm circumference (cm)	25.14 ±3.42	23.71 ±2.32	23.30 ±2.11	8.00	<0.001
Thigh circumference (cm)	51.99 ±5.21	50.76 ±5.15	50.26 ±4.89	2.46	0.06
Subscapular Skin fold (mm)	13.48 ± 8.48[a]	9.28 ±8.77[b]	7.62 ± 2.86[b]	9.75	<0.001
Triceps Skin fold (mm)	7.62 ±4.29[a]	6.03 ±2.29[b]	5.06 ±1.69[b]	9.57	<0.001
Calf Skin fold (mm)	11.11 ±6.85	8.99 ±5.16	10.00 ±14.86	1.35	0.26
Sum of 3 Skin folds (mm)	32.21 ± 16.85[a]	24.30 ± 12.46[b]	22.70 ± 15.61[b]	8.04	<0.001

Means with different superscript are significantly differently with P <0.05

Table 2: The anthropometric characteristics of Ibo women according to their level of exercise

Variables	No exercise (n=138)	Irregular exercise (n=80)	Regular exercise (n=17)	F	p
Age (years)	32.54 ± 13.64	36.46 ± 15.27	32.06 ± 16.27	1.81	0.15
Height (cm)	66.81 ± 14.45	62.95 ± 13.49	59.94 ± 11.36	1.64	0.18
Weight (kg)	160.01 ± 7.45	159.36 ± 6.22	162.42 ± 1.83	1.02	0.38
BMI (kg/m^2)	25.87 ± 5.43	24.79 ± 5.13	22.77 ± 4.28	2.20	0.09
Systolic BP (mmHg)	117.53 ± 27.16	117.04 ± 21.89	115.27 ± 14.36	0.52	0.66
Diastolic BP (mmHg)	78.62 ± 14.12	76.86 ± 12.62	74.89 ± 10.74	0.6	0.57
Waist circumference (cm)	87.21 ± 13.02	85.37 ± 12.52	79.62 ± 10.25	2.37	0.07
Hip circumference (cm)	98.70 ± 10.99	96.38 ± 10.89	93.41 ± 7.55	1.74	0.16
Arm circumference (cm)	28.86 ± 4.05	28.76 ± 3.75	27.17 ± 3.27	1.52	0.21
Forearm circumference (cm)	22.32 ± 2.8	22.18 ± 2.51	21.82 ± 0.62	0.19	0.90
Thigh circumference (cm)	51.49 ± 7.46	50.71 ± 5.78	48.59 ± 5.30	1.07	0.36
Subscapular Skin fold (mm)	18.31 ± 9.67	17.54 ± 7.15	19.33 ± 1.36	2.18	0.09
Triceps Skin fold (mm)	17.12 ± 8.98	16.16 ± 7.76	14.29 ± 6.72	1.02	0.39
Calf Skin fold (mm)	20.30 ± 8.79	22.01 ± 7.56	17.73 ± 7.85	1.83	0.14
Sum of 3 Skin folds (mm)	55.61 ± 24.79	55.39 ± 20.79	45.73 ± 19.08	1.59	0.19

Table 3 presents anthropometric characteristics and BP of married Igbo men according to three groups of physical exercise. Majority of the variables showed significant decrease from the No Exercise group to the Regular Exercise group, except height, systolic BP and calf skinfold thickness.

In married women (**Table 4**), the reduction pattern from No Exercise to Regular Exercise group is also observed but the differences were not statistically significant except for weight, BMI, waist circumference, hip circumference which showed significant differences (P<0.05).

Table 2: The anthropometric characteristics of married Igbo men according to their level of exercise

Variables	No exercise (n=71)	Irregular exercise (n=35)	Regular exercise (n=14)	F	P
Age (years)	45.72 ± 2.56	45.11 ± 13.03	45.43 ± 10.73	0.03	0.97
Height (cm)	167.93 ± 8.03	168.25 ± 7.67	168.93 ± 3.96	0.11	0.90
Weight (kg)	76.41 ±5.60[a]	68.77 ±14.22[b]	63.50 ±11.69[b]	6.21	0.003
BMI (kg/m^2)	27.08 ± 5.13 [a]	24.17 ± 4.10 [b]	22.21 ± 3.77 [b]	8.72	<0.001
Systolic BP (mmHg)	133.63 ±28.92	126.14 ± 5.44	124.92 ±31.18	1.13	0.33
Diastolic BP (mmHg)	89.21 ±11.52[a]	82.76 ±16.05[b]	82.36 ±13.68 [b]	3.57	0.03
Waist Circumference (cm)	90.81 ±10.27 [a]	85.11 ± 9.29 [b]	79.07 ± 6.65[b]	10.55	<0.001
Hip Circumference (cm)	97.67 ±12.31[a]	94.51±10.19[ab]	89.41 ± 7.33[b]	3.47	0.03
Arm Circumference (cm)	31.11 ± 3.39 [a]	29.05 ± 3.02[b]	27.63 ± 3.12[b]	9.29	<0.001
Forearm Circumference (cm)	25.51 ±4.2[a]	23.45 ± 2.45 [b]	23.37 ± 2.74[b]	6.64	0.002
Thigh Circumference (cm)	53.47 ± 5.07 [a]	50.02 ±5.6 [b]	47.59 ±5.29[b]	10.00	<0.001
Subscapular Skin fold (mm)	18.52 ±10.60 [a]	12.97 ±11.16[b]	7.83 ±3.73[b]	8.05	<0.001
Triceps Skin fold (mm)	9.31 ±5.07[a]	6.91 ±5.25[ab]	4.94 ±2.10[b]	6.12	0.003
Calf Skin fold (mm)	12.55 ± 7.78	9.26 ±5.70	14.47 ± 27.31	1.42	0.25
Sum of 3 skin folds (mm)	40.38 ±18.47[a]	29.14 ±17.45[b]	27.25 ±27.75[b]	5.36	0.006

Means with different superscript are significantly differently with P <0.05

Table 4: The anthropometric characteristics of married Igbo women according to their level of exercise

Parameter	No exercise (n=68)	Irregular exercise (n=45)	Regular exercise (n=7)	F	p
Age (years)	41.21 ± 13.63	45.67 ± 13.56	44.71 ± 17.80	1.32	0.27
Height (cm)	159.42 ± 7.65	158.22 ± 6.08	158.57 ± 6.20	0.41	0.67
Weight (kg)	72.26 ±15.34[a]	65.21 ±15.00[b]	60.86 ±14.50[b]	3.97	0.02
BMI (kg/m^2)	28.38 ± 5.43[a]	26.01 ± 5.56[b]	24.11 ± 4.96[b]	3.78	0.03
Systolic BP (mmHg)	127.71 ±33.56	122.78±25.55	123.43 ±17.73	0.38	0.68
Diastolic BP (mmHg)	82.89 ± 16.64	78.70 ± 14.19	78.09 ± 7.67	1.14	0.32
Waist Circumference (cm)	95.38 ±11.36[a]	90.78 ±12.39[b]	86.71 ± 9.71[b]	3.23	0.04
Hip Circumference (cm)	104.48±10.38[a]	99.57 ±10.53[b]	97.29 ± 6.13[b]	3.96	0.02
Arm Circumference (cm)	30.59 ± 4.25	29.65 ± 3.63	28.89 ± 3.70	1.11	0.33
Forearm Circumference (cm)	22.91 ± 2.38	22.32 ± 2.65	22.14 ± 3.22	0.90	0.41
Thigh Circumference (cm)	52.78 ± 8.65	50.68 ± 5.78	47.43 ± 5.22	2.21	0.12
Subscapular Skin fold (mm)	22.57 ± 10.19	19.75 ± 9.67	18.74 ± 7.61	1.48	0.23
Triceps Skin fold (mm)	19.94 ± 9.21	17.54 ± 8.26	18.14 ± 5.87	1.06	0.35
Calf Skin fold (mm)	22.67 ± 8.52	21.75 ± 8.36	20.31 ± 7.70	0.35	0.71
Sum of 3 skin folds (mm)	65.18 ± 24.85	58.86 ± 22.35	57.86 ± 22.35	1.15	0.32

Means with different superscript are significantly differently with P <0.05

The nature of adiposity and BP in never married men and women are presented in **Table 5** and **6**. In all the variables there is a consistent decrease from No Exercise group to Regular Exercise group. In never married men (**Table 5**) waist circumference, forearm circumference, subscapular skinfold thickness showed significant difference between sedentary subjects

(No exercise) and the active groups (Irregular and Regular exercise). In the never married women, there is no significant difference except in calf skinfold thickness.

Table 5: The anthropometric characteristics of never married Igbo men according to their level of exercise

Parameters	No exercise (n=76)	Irregular exercise (n=84)	Regular exercise (n=42)	F	p
Age (years)	28.92 ± 5.68[a]	25.29 ± 4.99 [b]	24.48 ± 4.54 [b]	9.64	<0.001
Height (cm)	172.40 ± 6.62	171.11 ± 7.56	173.20 ± 7.14	0.86	0.46
Weight (kg)	71.30 ± 0.50[a]	67.55 ± 9.07[b]	69.93 ± 9.95[b]	2.00	0.12
BMI (kg/m^2)	23.95 ± 2.88	23.01 ± 2.34	23.22 ± 2.19	1.96	0.12
Systolic BP (mmHg)	117.11±13.09	115.12 ± 6.86	114.12 ± 4.54	1.30	0.28
Diastolic BP (mmHg)	79.07 ± 9.73	77.07 ± 9.74	79.15 ± 8.91	1.55	0.20
Waist Circumference (cm)	80.95 ± 7.26 [a]	77.61 ± 7.51[b]	77.51 ± 5.28[b]	3.99	0.01
Hip Circumference (cm)	93.50 ± 6.44	91.60 ± 5.58	91.22 ± 6.64	2.05	0.11
Arm Circumference (cm)	28.94 ± 2.29	28.92 ± 2.71	28.33 ± 1.90	0.69	0.56
Forearm Circumference (cm)	24.78 ± 2.25[a]	23.75 ± 2.21 [b]	23.58 ± 1.79 [b]	4.24	0.01
Thigh Circumference (cm)	51.02 ± 5.02	51.30 ± 5.13	50.98 ± 4.58	0.51	0.67
Subscapular Skin fold (mm)	10.11 ± 5.58[a]	8.12 ± 3.62[b]	7.57 ± 2.53[b]	4.27	0.01
Triceps Skin fold (mm)	6.12 ± 2.40	6.07 ± 2.23	5.12 ± 1.54	2.29	0.08
Calf Skin fold (mm)	9.80 ± 5.39	9.21 ± 5.39	8.42 ±6.72	0.55	0.65
Sum of 3 Skinfolds (mm)	26.03 ± 12.06	23.40 ± 9.87	21.11 ± 8.20	2.17	0.09

Means with different superscript are significantly differently with P <0.05

Table 6: The anthropometric characteristics of never married Igbo women according to their level of exercise

Parameters	No exercise (n=72)	Irregular exercise (n=35)	Regular exercise (n=10)	F	p
Age (years)	23.71 ± 4.59	24.32 ± 6.31	23.20 ± 6.90	0.23	0.79
Height (cm)	160.66 ±7.17	160.82 ±6.19	165.10 ±7.49	1.84	0.16
Weight (kg)	60.34 ± 0.54	60.04 ± 0.69	59.30 ± 9.39	0.05	0.96
BMI (kg/m^2)	23.42 ± 4.15	23.22 ± 4.08	21.82 ± 3.72	.067	0.51
Systolic BP (mmHg)	107.29±12.12	109.44±12.56	109.56 ±8.32	0.45	0.64
Diastolic BP (mmHg)	74.51 ± 9.27	74.44 ± 9.97	72.66 ± 12.35	0.16	0.85
Waist Circumference (cm)	79.19 ± 8.92	78.43 ± 8.79	74.66 ± 7.58	1.18	0.31
Hip Circumference (cm)	93.11 ± 8.27	92.29 ± 10.06	90.70 ± 7.51	0.38	0.69
Arm Circumference (cm)	27.15 ± 3.00	27.61 ± 3.64	25.96 ± 2.43	1.08	0.35
Forearm Circumference (cm)	21.76 ± 3.03	22.00 ± 2.33	21.60 ± 2.09	0.13	0.88
Thigh Circumference (cm)	50.18 ± 5.88	50.74 ± 5.82	49.40 ± 5.48	0.23	0.79
Subscapular Skin fold (mm)	14.069 ± 7.76	14.83 ± 7.18	9.90 ± 4.04	2.05	0.13
Triceps Skin fold (mm)	14.25 ± 7.76	14.38 ± 6.78	11.60 ± 6.15	0.62	0.54
Calf Skin fold (mm)	17.94 ± 8.37[a]	22.35 ± 6.46[b]	15.92 ± 7.82[a]	4.5	0.01
Sum of 3 skin folds (mm)	46.06 ± 20.79	50.93 ± 17.93	37.42 ± 16.31	1.96	0.15

Means with different superscript are significantly differently with P <0.05

DISCUSSION

The present study showed sexual dimorphism in the anthropometric characteristic and blood pressure of the subjects. Female subjects have high BMI (overweight), significant skinfold thickness, waist circumference, hip circumference while the male subjects have high values of arm circumference and blood pressure. The result of this study agrees with the report by **Wang et al**[12] and **Flegal**[13] that waist circumferences differ in magnitude depending on sex, are highly reproducible and are correlated with total body and trunk adiposity in a sex-dependent manner.

The present study also observed differences in BP of men and women. These sex differences were noted with men having significantly higher SBP and DBP than the women. In support of the present study is the report by **Kusuma et al**[14] that in general, men possess higher blood pressure (both systolic or diastolic) levels than women. This finding could also be explained using a recent report by **Khan et al**[15] which shows that the anthropometric parameters did not associate with BP in women and they suggest it was mitigated by hormonal changes, but found that BP correlates with age in females.

Although evidence relating to differences in habitual physical activity associated with marital status are equivocal, some evidence suggest that married men and women have lower estimated daily levels of physical activity in leisure which is higher in mothers than fathers[16,17]. This may reflect higher parental duties and in turn less time for physical activity and perhaps lower motivation for thinness among men after finding a spouse[18-21].

On the other hand, obesity, which often co-exists with the married state, is a risk for several degenerative diseases, heart disease, hypertension, diabetes, several cancers and premature mortality[5,22]. In spite of a higher prevalence of obesity/ overweight, married men and women have lower morbidity and mortality, suggesting perhaps an epidemiological paradox[18]. However, we do not have available data here in Nigeria on the morbidity and mortality rate of the married as to explain the existence of this epidemiological paradox since the present study indicated elevated blood pressure and significant level of fatness for the married.

Subjects who regularly exercise have lower values of adiposity measures and blood pressure while those who never exercise, equivalent to the sedentary workers; in most cases have significantly high level of adiposity and elevated blood pressure except the never married men and women who indicated low level of BP, normal BMI and other adiposity measures. Similar results have been reported by **Wardle et al**[2], **van Walleghen et al**[23] and **Houston et al**[24]. Although married men and women have lower estimated levels of physical activity in leisure[16] however, married individuals who participate regularly exercise have significantly have lower adiposities and BP and this increase their health advantage over the other groups.

Results of this study suggest the modulating effect of exercise on BP; the observation in all the groups is that BP tends to reduce in mean value as the level of physical activities increases and this supports the report that overall exercise capacity has a very strong association with cardiac events and all cause mortality in patients with known or suspected coronary artery disease[25-27].

In addition the lack of significant difference among the three exercise groups of women unlike the men, may imply that female needs extra strength to induce lipolysis. Supporting this is the evidence indicating that catecholamine induced lipolysis is lower in females than in males and the resting rate of fat oxidation adjusted for fat free mass is lower in females than in males[28]. Also lack of significant differences in most cases among the exercise groups of the never married (men and women) implies that this population is in the active state and probably because posture allocation in the sedentary group approximates that of the other two groups, since both groups have normal adiposity levels and BP.

CONCLUSION

There is reduction in the mean values of adiposity measures and BP values as the frequencies of physical exercise increases. Married men and women are the one at greater risk and should be encouraged to actively engage in physical activities of different kinds.

ACKNOWLEDGEMENT

We thank the leadership of the Igbo community in Zaria, the Head of Igbo Department, School of Linguistics, Federal College of Education (FCE), Zaria, Mr. O. Nnamdi and Miss Judith Uduluriawa for the support they provided in the course of the data collection. We are also grateful to the subjects who volunteered for the study despite their busy schedules.

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