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COMPARISON OF MODIFIABLE CORONARY ARTERY DISEASE RISK FACTORS BETWEEN URBAN BLACK AND WHITE FEMALES

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ABSTRACT

Objective: The aim of the present study was to compare the incidence of the following coronary artery disease (CAD) risk factors in urban (westernised) Black and White females: physical inactivity, hypertension, cigarette smoking, hypercholesterolaemia, obesity and multiple risk factors. Subjects: Subjects for this study were 62 Black females, paired for age (18-49, Mean = 32.5 years) with 62 White females. Results: Black females (72.6%) were more inactive than White females (51.6%). The mean Physical Work Capacity^{170} (PWC$^{170)}$ for the Black females (107.8 ± 33.0 W) was significantly lower (P<0.05) than that of White females (129.1 ± 24.2 W). Black females (11.6%) had a higher incidence of mild to moderate systolic hypertension (140-179 mmHg) than White females (6.4%). Fewer Black females (3.2%) smoked cigarettes than White females (21%). White females (high risk = 25%) were clearly at far greater risk than Black females (high risk = 0%) with regards to CAD associated with high cholesterol levels. Black females (60.3%) were more obese (fat ≥30%) than White females (27.4%). Mean BMI of Black females (30.2 ±6.8) was significantly higher than for White females (24.0 ±4.7). White females with 22.6% of individuals displaying three or more risk factors as against the Black female's 14.5% are at greater risk for CAD. Conclusion: White females have a significantly higher risk for CAD than westernised Black females, but there are indications that Black females are closing the gap.

Key words: Coronary artery disease risk factors; Urban White females; Urban Black females; Modifiable CAD risk factors.

INTRODUCTION

Multiple risk factors can contribute to the development of coronary artery disease (CAD) in an individual. The major modifiable risk factors for CAD are physical inactivity, cigarette smoking, hypertension, hypercholesterolaemia and obesity (Robergs & Roberts, 1997). CAD has been identified as a major national health problem and is the leading cause of death in the white population of Durban (Seedat *et al*., 1994). It is known that the patterns of health and fitness status of the various population groups are different (Seedat & Mayet, 1996) and are also changing due to changes in lifestyle. Urbanisation and westernisation among black females in South Africa has and are continuing to play a significant role in changing the pattern of health risk factors. Whereas CAD was not a major cause of death among black populations of South Africa in the past (Seedat & Mayet, 1996) the situation is fast changing due to the factors mentioned above. The identification of modifiable risk factors for CAD in different populations could contribute significantly in educating those at risk as well as to the

introduction of prevention and treatment programmes. Comparing different population groups could assist in identifying specific factors contributing to the development of CAD.

The aim of the present study is to compare the incidence of CAD risk factors in urban (westernised) Black and White females in an attempt to determine which group is at greater risk.

METHODS AND PROCEDURES

Subjects for this study consisted of 62 urban Black females paired for age with 62 White females. All subjects were recruited when they voluntarily decided to join a fitness centre for the first time. The mean age for both groups were 32.5±8.5 years with a minimum of 18 years and a maximum of 49 years. The mean mass for the Black females were 78.7±19.1 kg with a minimum of 52.0 kg and a maximum of 138.0 kg and for the White females a mean of 65.7±13.2 kg with a minimum of 45.9 kg and a maximum of 99.8 kg. The mean height for the Black females were 1.61±0.1 m with a minimum of 1.5 m and a maximum of 1.7 m and for the White females a mean of 1.65±0.1 m with a minimum of 1.6 m and a maximum of 1.8 m.

All subjects completed the PAR-Q questionnaire (Corbin & Lindsey, 1994) and provided the tester with informed consent. Subjects were free to withdraw from the test at any time. Testing took place during the hours of 16h00 to 18h00 from Monday to Thursday. The testing centre was fully air-conditioned which enabled a stable environment as regards temperature and humidity. Subjects were dressed in comfortable exercise clothes during the tests.

Tests were performed as follows:

The tester interviewed the subject and recorded information regarding date of birth, exercise habits, smoking habits and health status. Thereafter height and mass was measured. All testing was done strictly according to a predetermined protocol. Fat percentage was calculated from the skin folds taken with a slimguide calliper by means of the method described by Pollock *et al*. (1980). Blood pressure was measured at rest in the sitting position by the conventional manual method using a stethoscope and sphygmomanometer. If the blood pressure was above 120/80 mmHg the procedure was repeated to verify the finding. If it was above 140/90 mmHg a further measurement was taken. The blood total-cholesterol level was measured by means of a Boehringer Accutrend GCT. Due to the unavailability of the apparatus for a portion of the testing period this test was not done on the whole cohort of subjects. Physical working capacity (PWC^{170}) was determined with the subject cycling on a calibrated cycle ergometer, starting at ±30 W and increasing the workload by 20 to 30 W every two minutes depending on the fitness state of the subject. Heart rate (Polar heart rate monitor) and blood pressure (mercury sphygmomanometer) was recorded at the end of each two-minute period. The PWC^{170} was calculated using the methods described by Åstrand and Rodahl (1977). In the current study exercise habits were determined by questioning the individual and subjectively rating the level of activity according to the answers given.

RESULTS AND DISCUSSION

Physical activity profile

There is consensus that regular physical activity is a powerful protector against heart disease. The relative risk of a fatal heart attack among sedentary individuals is approximately twice that of more active persons (Blair, 1993; Morris, 1994). The physical activity profile for the Black and White females in this study is shown in table 1. Although twice as many Black than White females participated in regular physical activity the overall profile indicate that the White females are more active than their Black counterparts. While 72.6% of Black subjects were inactive and therefore at risk, only 51.6% of the White subjects were inactive.

TABLE 1. **PHYSICAL ACTIVITY PROFILE FOR BLACK AND WHITE FEMALES**

	Percentage participation	
Activity level	Black females (n=62)	White females (n=62)
Inactive	72.6	51.6
Irregular physical exercise	11.3	40.3
Regular physical exercise	16.1	8.1

Physical condition can also be estimated from the physical working capacity at a heart rate of 170 bpm ($PWC^{170)}$ as this parameter depends on heart rate, which in turn is affected by the state of fitness of the subject. Therefore, if a specific population scores higher than the general population norm in the PWC^{170}, this is a sure indication of a higher degree of fitness. The mean PWC^{170} for the Black females (107.8 ± 33.0 W) was 19.9% lower than for the White females (129.1 ± 24.2 W). This difference is statistically significant ($P<0.05$) and substantiates the finding that the Black females of the current study were less active than their White counterparts. Whereas the mean PWC^{170} of the White females was somewhat higher than the population norm (117.5 W) reported by Andrews (1990) for 548 female subjects aged 18 to 55 years, the PWC^{170} of the Black females were below the population norm.

Blood pressure

Hypertension is the most common cardiovascular disease in human populations and chronic hypertension can lead to heart failure, myocardial infarction or stroke McArdle *et al*., 2001). The blood pressure data for the current subjects are displayed in table 2. Although mean systolic and diastolic blood pressure of the Black and White subjects did not differ significantly ($P>0.05$) the Black females seems to be at a slightly higher risk for CAD. When judged against the norms of the American College of Sports Medicine (1995), 11.6% of the Black females displayed mild to moderate systolic hypertension (140-179 mmHg) compared to 6.4% of the White females. Black females consistently had more individuals in the higher risk categories (Table 2).

TABLE 2. **BLOOD PRESSURE RISK PROFILE OF BLACK VERSUS WHITE FEMALES**

Risk category and blood pressure range (mmHG)		Percentage of subjects per category	
		Black females (n=62)	White females (n=62)
SYSTOLIC BLOODPRESSURE			
Normal	(<130)	76.7	83.9
High normal	(130-139)	11.7	9.7
Mild hypertension	(140-159)	10.0	4.8
Moderate hypertension	(160-179)	1.6	1.6
Severe hypertension	(180-209)	0	0
DIASTOLIC BLOODPRESSURE			
Normal	(<85)	63.3	74.2
High normal	(85-89)	20.0	8.1
Mild hypertension	(90-99)	13.3	17.7
Moderate hypertension	(100-109)	3.3	0
Severe hypertension	(110-119)	0	0
Norms from: American College of Sports Medicine (1995)			

Smoking habits

Cigarette smoking may be one of the best single predictors of CAD; the risk is directly related to the number of cigarettes smoked. Whereas smoking generally acts independently of other risk factors, it also accentuates the influence of other risk factors that may be present (McArdle *et al*., 2001). The results of the current study indicate that, whereas a very small percentage (3.2%) of Black females smoked cigarettes, 21% of White females smoked more than 10 cigarettes per day. This finding corresponds with the findings of Seedat and Mayet (1996) who found that 3.4% of Black females and 24.1% of White females tested in the Durban area smoked more than 10 cigarettes per day.

Total Cholesterol profile

Abnormal blood lipid profiles appear to contribute significantly to atherosclerotic diseases and thereby constitute a real risk for CAD (Smith, 1991; Stamler *et al*., 1986). Although total cholesterol is not as powerful a predictor as the distribution among the various lipoproteins, it is still a valuable screening factor and due to the ease of measurement and low cost it is widely used. A total cholesterol level of >5.2 $mmol.l^{-1}$ is regarded as a risk factor for CAD (American College of Sports Medicine, 1995). In the present study (see Table 3) where CAD risks associated with high cholesterol levels are judged on the classification of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (1993), White females were clearly at far greater risk for CAD than Black females. Whereas no Black females were in the high-risk category, 25% of the White females fell into this category. Among Black females only 5.6% were found to be border line as against 16.7% of White females.

TABLE 3. **COMPARISON OF TOTAL CHOLESTEROL OF BLACK AND WHITE FEMALES**

Risk category and cholesterol concentration ($mmol.l^{-1}$)		Percentage of subjects in each category	
		Black females (n=18)	White females (n=18)
Desirable	(<5.2)	94.4	58.3
Borderline	(5.2-6.2)	5.6	16.7
High	(>6.2)	0	25.0
Norms from: Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (1993)			

Over-fatness and obesity

Although not a primary risk factor for CAD, obesity is recognised as an independent risk factor (Pollock *et al*., 1980). Obesity has a close relationship with other risk factors such as hypertension, elevated cholesterol and diabetes mellitus. Weight loss accompanied by body fat reduction, whether through diet or exercise, generally normalise cholesterol and trigliseride levels and have a beneficial effect on blood pressure and Type II diabetes (McArdle *et al*., 2001). Results from the current study indicate that Black females are at greater risk than White females when body composition is considered. Black females were significantly ($P<0.05$) heavier (Mass = 78.7 ±19.1 kg) than their White counterparts (Mass = 65.7±13.2 kg). This trend continued when fat percentage was compared. Significantly more Black females (60.3%) were obese (fat ≥30%) than White females (27.4%). Body mass index (BMI), which is frequently used by clinicians and researchers to evaluate normalcy of body weight, also indicated that Black females were at greater risk than their White counterparts. Mean BMI differed significantly between the Black females (30.2 ±6.8) and the White females (24.0 ±4.7). Table 4 shows the BMI distribution for the subjects of the current study and also evaluate the BMI against risk categories for all cause mortality (McArdle *et al*, 1996). A greater proportion of Black females (42.0%) than White females (16.1%) fell in the moderate to very high risk categories.

TABLE 4. **CONTRIBUTION OF BMI TO ALL CAUSE MORTALITY FOR BLACK AND WHITE FEMALES**

Risk category and BMI range		Percentage of subjects in each category	
		Black females (n=62)	White females (n=62)
Moderate	(0-19.9)	1.6	19.4
Very low	(20-24.9)	19.4	51.6
Low	(25-29.9)	37.1	12.9
Moderate	(30-34.9)	19.4	12.9
High	(35-39.9)	11.3	3.2
Very high	(≥ 40)	11.3	0
Norms from: McArdle *et al*. (2001)			

Table 5 shows the differences in skin fold thickness between the Black and White females of the current study which gives an indication of the distribution of fat for the two groups. The means for the two subject groups for all the sites differ significantly ($P<0.05$). The greatest difference was found at the sub scapula followed by the supra iliac and the triceps.

TABLE 5. **FAT DISTRIBUTION AS PER SKIN FOLD FOR BLACK VERSUS WHITE FEMALES**

Skin folds	Mean and standard deviation (mm)		% difference	Statistical difference
	Black females (n=62)	White females (n=62)		
Triceps	25.8	19.1	26.0	P<0.05
Biceps	14.8	11.3	23.6	P<0.05
Thigh	44.7	34.9	21.9	P<0.05
Calf	26.9	20.4	24.2	P<0.05
Abdomen	28.3	22.3	21.2	P<0.05
Sub scapula	26.3	17.5	33.5	P<0.05
Supra iliac	20.7	15.2	26.6	P<0.05

Multiple Modifiable Risk Factors

Risk appraisals have been developed to quantify an individual's susceptibility to CAD. Most of these appraisals assign point values to different aspects of lifestyle. Often these values are arbitrary and not based on actual data of mortality and morbidity. Despite this limitation, such appraisals do play an important role in screening for current risks and lifestyle behaviours. The following risk factor norms for CAD are commonly recognised: Cigarette smoking ($>10.day^{-1}$), Physical inactivity, Hypo-kinetic conditions such as diabetes, Hypertension (>140/90 mmHg), Obesity (Fat mass >30% or BMI $>27.3\ kg.m^2$) and hyper-cholesterolaemia ($>5.2\ mmol.l^{-1}$). It is difficult to determine quantitatively the importance of any single risk factor in comparison to any other because the factors are interrelated. Many risk factors are associated with each other as well as with CAD. The interaction of three or more of the primary risk factors, when present in the same person, most definitely magnifies their individual effects (McArdle *et al*., 2001).

TABLE 6. **MULTIPLE CORONARY ARTERY DISEASE RISK FACTOR PROFILE OF BLACK AND WHITE FEMALES**

Number of risk factors per individual	Percentage of subjects per category	
	Black females (n=62)	White females (n=62)
0	6.45	8.1
1	33.9	37.1
2	45.2	32.3
3	12.9	21.0
4	1.6	1.6

Table 6 gives a profile of multiple risk factors for subjects in the present study. Both groups are clearly at risk due to multiple risk factors being present in individuals. However, the White females, having 22.6% of individuals with three or more risk factors as against the Black subject's 14.5%, must be regarded as having the greater risk for CAD. Although traditionally Black populations did not have an elevated risk for CAD, the urban (westernised) Black subjects in the present study clearly displays an increased risk, albeit not yet at the same level as their White counterparts.

CONCLUSION

The aim of this study was to determine which of Black or White females presented with the greatest risk for CAD. Although both groups are at definite risk for CAD the results, when judged holistically, indicate that White females have a significantly higher risk for CAD. Black females fared worse in the following risk factors: physical activity (somewhat), blood pressure (slightly) and obesity (substantially) whereas White females fared worse in tobacco smoking (substantially), cholesterol (substantially) and multiple risk factors per individual (somewhat). It is recommended that further research is conducted to monitor the changes in CAD profiles of black females.

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