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AN ASSESSMENT OF THE PHYSICAL FITNESS AND CORONARY HEART DISEASE RISK FACTORS OF WHITE FEMALES IN THE ZULULAND AREA THAT ATTEND HEALTH AND FITNESS CLUBS

Marius F. COETSEE
Department of Human Movement Science, University of Zululand, KwaDlangezwa, Republic of South Africa

ABSTRACT

Health and fitness clubs play an important role in addressing the causes of hypo-kinetic diseases and coronary heart disease (CHD). In order to be well prepared, service providers should be aware of the health and fitness profiles of their clients when they join their clubs. In the current study 243 white female subjects between ages 13 to 70 years were assessed, the results analysed for risk factors and the findings compared with existing norms in literature. This study found that 19.8% of subjects smoked >10 cigarettes per day which is a cause for concern. Although this is lower than the general female population of Durban the current subjects joined a health and fitness centre and could thus be regarded as health conscious. Before joining almost half (49.4%) of the subjects were inactive. The incidence of hypertension (systolic >140 mmHg and/or diastolic >90 mmHg) as a risk factor for (CHD) among 16.5% of subjects was relatively low when compared to that reported for females in Durban. Cholesterol levels were also lower than the average for Durban females because 28.6% of the subjects were found to be borderline (5.2-6.2 mmol.l^{-1}) and 16.7% to be of a high risk (>6.2 mmol.l^{-1}). When using BMI, 19.3% of subjects were >37.3 kg.m^{-2} and therefore in a high-risk group for CHD. Multiple risk factor analysis revealed that 42.0% of subjects displayed two or more risk factors for CHD while 12.0% had three or more and 2.0% had four or more.

Key words: Risk factors; Health; Fitness; White females; Fitness assessment.

INTRODUCTION

Health and fitness clubs play a very important role in preventing hypo-kinetic conditions. Of particular importance are the modifiable risk factors for coronary heart disease (CHD). The South African population is, especially in urban areas, increasingly becoming aware of the benefits of physical exercise for improvement of health and the quality of life. More than ever, individuals join fitness clubs in their quest to stay fit and healthy. Many individuals join fitness clubs because they have limited knowledge of fitness and health aspects and have come to seek advice as to the best programmes to follow. Many individuals that seek to participate in exercise have limited leisure time and wish to do the most in the shortest space of time. Therefore, it is imperative for fitness clubs to offer services suited to the particular needs of their customers. Without a clear knowledge of the health and fitness profile of its target market it is difficult for health and fitness clubs to offer appropriate services.

When an individual joins a health and fitness club he/she usually has a very poor idea of his/her health and fitness status and the potential benefits of exercise. One of the main

benefits is the reduction of modifiable health risk factors. Coronary artery disease has been identified as a major national health problem and prior to 1994 was the leading cause of death in the white population of Durban (Seedat *et al*., 1994). Organisations involved in preventive health measures, which includes health and fitness clubs, should be particularly sensitive to identifying risk factors, and implementing effective ways to reduce such risk factors. The major modifiable risk factors for CHD are cigarette smoking, hyper-cholesterolaemia, physical inactivity, diabetes mellitus, hypertension, stress, and obesity (Robergs & Roberts, 1997).

In the present study a survey of the incidence of modifiable risk factors and other physical shortcomings among first time entrants to a local health and fitness club was done and recorded. This research could therefore be of valuable assistance to decision-makers in the health and fitness industry, as it can help to determine the needs of the average customer.

METHODS AND PROCEDURES

Data are reported for 243 white female subjects who joined the Empangeni Health and Fitness Centre between January 1999 and December 2001. Table 1 represents the general characteristics of the subjects. All subjects gave written consent prior to participation in the project. All subjects also completed the PAR-Q questionnaire (Corbin & Lindsey, 1994). Subjects were free to withdraw from the test procedure at any time. Testing were done between 16h00 and 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 clothing during the tests.

TABLE 1. **GENERAL CHARACTERISTICS OF SUBJECTS (N=243)**

Parameter	Mean	Min	Max
Age (yr)	32.7 ± 11.0	13	70
Mass (kg)	66.1 ± 13.0	44	130
Height (cm)	165.0 ± 5.0	151	181

Tests were performed as follows:

The examiner interviewed each subject individually and recorded information regarding the date of birth, exercise habits, smoking habits and health status. Height and mass was measured next. Fat percentage was calculated from the skinfolds 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 stethoscope/sphygmomanometer method. Random total blood-cholesterol concentration was measured by means of a Boehringer Accutrend GCT apparatus. The method described by the manufacturer was followed precisely. Random cholesterol is a useful screening tool and can be compared to results of other researchers who have used the same method. Physical working capacity (PWC_{170}) and predicted maximal oxygen consumption (VO_{2max}) were determined with the subject cycling on a calibrated cycle ergometer, starting at ±30W 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} and VO_{2max} were calculated using the methods described by Åstrand and Rodahl (1977). Sit-ups were done from supine position, with fingers touching behind the head, to a

position where elbows touched the upper legs; the knees bent 90 degrees. Push-ups were done with the knees on the floor and the body, from shoulder to knee, forming a straight line until the arms were fully extended. Thereafter the body was lowered to a level where the elbows were bent 90 degrees. Calf flexibility was determined by measuring the angle between the floor and the lower leg as follows: The subject stood with feet parallel to each other and 10 cm apart. With the hands on a one meter high bench a meter away from the subject, she attempted to lean forward into dorsi-flexion as far as possible without lifting the heals off the floor. If the subject was unable to reach an angle of 45 degrees between the floor and lower leg, it was regarded as insufficient flexibility of the calf muscle. Hamstring length was measured with the subject lying on the back with the trochanter of the femur level with the mid-point of a large protractor. While the subject kept the leg muscles relaxed the tester gripped the leg just above the ankle and slowly lifted the leg to determine the angle at which the hamstring started to flex the knee. A value of less than 60 degrees was regarded as insufficient. Hip flexor length was measured with the subject lying on the back on a couch and then pulling one knee (fully flexed) down onto the chest with both hands. A noticeable lift in the thigh of the opposite leg indicated a short hip-flexor on that side. The procedure was then repeated for the other side. Shoulder range of motion was measured by standing about one meter from a couch of one metre in height. By bending in the hips, the hands and wrists were positioned on the couch. The subject then attempted to push the shoulders down as far as possible while keeping the arms straight. A slight bend in the knees was allowed. An angle of less than 180 degrees between back and arms signified insufficient shoulder range of motion.

RESULTS AND DISCUSSION

Smoking habits

Smoking is widely recognised as a major risk factor for coronary heart disease. Cigarette smoking may be one of the best predictors of CHD; 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*., 1996). In the present study subjects smoked an average of 16.0 ± 7.4 cigarettes per day with 19.8% of subjects smoking ≥10 cigarettes per day. This is slightly lower than what was reported by Seedat and Mayet (1996). They found that 24.1% of 203 white females in the Durban area smoked ≥10 cigarettes per day. This could indicate that the subjects of the present study, who joined a health and fitness club, might have been more sensitive to the negative effects of cigarette smoking. It is, however, still disconcerting that such a large proportion of females who elect to improve their health and fitness status, continue to smoke. It is suggested that special attention be given to inform smokers joining health and fitness clubs of the negative effects of smoking. This could effectively be done by means of an individual health risk profile that highlights those areas where the individual could improve on.

Exercise habits

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). However, it is difficult if not impossible to measure accurately the activity level of an individual. Under normal circumstances it can only be measured as a subjective rating. In the current study it was done

by questioning the individual and then to subjectively rate the level of activity according to the answers given.

Before joining the health and fitness club 49.4% of the subjects did not participate in any physical activity, while 30.9% reported irregular participation and only 19.8% reported regular participation. It is therefore clear that a lot of room for improvement in the area of physical activity, with it's accompanying benefits, is possible for the current subjects. As they have taken the decision to start with physical exercise by joining a health and fitness club, it is important that they get expert advice as to the type of exercise most needed and to ensure that they remain committed.

The physical condition of an individual can also be determined from the PWC_{170} and the predicted VO_{2max} as these parameters depend on heart rate which in turn is affected by the state of fitness of the subject. When predicting VO_{2max} from workload and heart rate unfit individuals will always under-score. Therefore, if a specific population scores higher than the norm for the general population in the above parameters, then one of the factors responsible for this could be a higher degree of fitness. The mean PWC_{170} for the subjects of this study was 130.4 ± 29.6 W with a maximum of 220 W and a minimum of 57 W. This is somewhat higher than the population norm (117.5 W) reported by Andrews (1990) for 548 female subjects aged 18 to 55 years. This could indicate that the present population is somewhat more active than the general population and might play a role in them joining a health and fitness club. The mean predicted VO_{2max} for the subjects of the present study was 2.5 ± 0.5 l/min with a maximum of 3.6.min^{-1} and a minimum of 1.1.min^{-1}. Relative values were 40.0 ± 10.0 ml.kg^{-1}.min^{-1} with a maximum of 65.0 ml.kg^{-1}.min^{-1} and a minimum of 13.0 ml.kg^{-1}.min^{-1}. This compares well with the 39.0 ml.kg^{-1}.min^{-1} reported by McArdle *et al*. (1996) as the average value for females in the USA.

Resting blood pressure profile

Chronic hypertension can lead to heart failure, myocardial infarction or stroke. It can, however, be effectively treated with lifestyle changes and medication. Beneficial lifestyle changes such as a prudent diet, weight control, and moderate exercise performed on a regular basis, are more desirable than the pharmacological approach for treating mild hypertension (McArdle *et al*., 1996).

Although hypertension is the most common cardiovascular disease in human populations, subjects in the current study displays a surprisingly low incidence of hypertension (Table 2). Hypertension (systolic >140 mmHg and/or diastolic >90 mmHg) as a risk factor for CHD was prevalent in 16.5% of subjects in the present study. This prevalence is clearly lower than the 17.7% prevalence of hypertension (≥160/95 mmHg) reported by Seedat and Mayet (1996) for white females from the Durban area. Again it could point to a bias in favour of healthier females joining health and fitness clubs. In the light of the very positive effect physical activity has on hypertension, recruitment strategies should also be targeted at persons who normally do not join health and fitness clubs but who could benefit the most.

TABLE 2. **SYSTOLIC AND DIASTOLIC BLOOD PRESSURE PROFILE OF WHITE FEMALES (N=243)**

Systolic		
Classification	**Range (mmHg)**	**Distribution (%)**
Normal	<130	81.07
High normal	130-139	11.52
Mild hypertension	140-159	6.58
Moderate hypertension	160-179	0.41
Severe hypertension	180-209	0
Very severe hypertension	≥210	0
Diastolic		
Normal	<85	77.37
High normal	85-89	8.23
Mild hypertension	90-99	13.99
Moderate hypertension	100-109	0
Severe hypertension	110-119	0
Very severe hypertension	≥ 120	0

Norms from: American College of Sports Medicine (1995)

Total Cholesterol profile

Abnormal blood lipid profiles appear to contribute significantly to atherosclerotic diseases and thereby constitute a real risk for CHD (Smith, 1991; Stamler *et al*., 1986). Although total cholesterol is not such a powerful predictor as the distribution of the various lipoproteins, it is still a valuable screening tool for due to the ease of measurement and economic viability it is widely used. A total cholesterol level of >5.2 mmol/l is regarded as a risk factor for CHD (American College of Sports Medicine, 1995). In the present study (see Table 3), if judged on the classification of the Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (1993), 54.8% had a desirable cholesterol level (<5.2 mmol.l^{-1}), 28.6% was borderline high (5.2-6.2 mmol.l^{-1}), and 16.7% had high cholesterol (>6.2 mmol.l^{-1}). These values are somewhat lower than those reported by Seedat and Mayet (1996) for white females of the Durban area. These authors (Seeadat & Mayet, 1996) found that 50% of females that they screened had cholesterol levels of ≥5.7 mmol.l^{-1} and 24.1% had levels of ≥6.5 mmol.l^{-1}. The females of the present study appear to be at lower risk than the females in Durban. There is, however, room for improvement and dietary adaptations and participation in regular aerobic type exercise is recommended.

TABLE 3. **BLOOD TOTAL CHOLESTEROL LEVELS IN THE PRESENT STUDY (N=43)**

Classification	Range (mmol.l^{-1})	Distribution %
Desirable	<5.2	54.76
Borderline high	5.2-6.2	28.57
High	>6.2	16.67

Over-fatness and obesity

Although not a primary risk factor for CHD, 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 and accompanying 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*., 1996).

Table 4 shows the distribution of the subjects of the present study for body fat % and BMI. The mean fat % of the subjects in this study was 26.2 ± 6.7% with a minimum of 10.0% and a maximum of 50.0%. The mean BMI of the subjects of this study was 24.2 ± 4.9 kg.m^{-2} with a minimum of 16.6 kg.m^{-2} and a maximum of 46.1 kg.m^{-2}. Using body fat % as a risk factor it can be seen from Table 4 that 28.0% of the subjects of the present study would be at increased risk for CHD. A BMI of above 37.3 kg.m^{-2} (McArdle *et al*., 1996) is associated with an increased incidence of high blood pressure, diabetes, and CHD. In the present study 19.3% of the subjects fell into this category.

TABLE 4. **BODY FAT % AND BODY MASS INDEX OF FEMALE SUBJECTS AS A FACTOR FOR CHD (N=243)**

Body fat %		
Classification *	**Range (%)**	**Distribution**
Desirable	<25	42.80%
Normal	25-29.9	28.80%
Obese	≥30	28.00%
Body Mass Index		
Contribution to all cause mortality *	**Range (kg.m^{2})**	**Distribution**
Moderate	0-19.9	14.80%
Very low	20-24.9	59.79%
Low	25-29.9	22.22%
Moderate	30-34.9	9.88%
High	35-39.9	1.65%
Very high	≥40	1.20%

* McArdle *et al*. (1996)

Multiple Modifiable Risk Factors

Risk appraisals have been developed to quantify an individual's susceptibility to CHD. 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 factors for CHD 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 (>5.2mmol.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 CHD. The interaction of three or more of the primary risk factors when elevated in the same person most definitely magnifies their individual effects (McArdle *et al*., 1996).

Table 5 gives a profile of risk factors of subjects in the present study. In the present study 42.0% of subjects had two or more risk factors, 12.0% had three or more risk factors and 2.0% had four or more risk factors. This is clearly a cause for concern and should be noted by the persons in charge of exercise programme prescription in health and fitness clubs. The elimination or reduction of one or more risk factors will cause a corresponding decrease in the probability of developing CHD.

TABLE 5. **MULTIPLE MODIFIABLE RISK FACTOR PROFILE (N=243)**

Number of risk factors* present	Distribution (%)
1	33.74
2	29.63
3	10.29
4	1.23
5	0.41
6	0.41

* Cigarette smoking (>10.day^{-1}), Physical inactivity, Hypo-kinetic conditions such as diabetes, Hypertension (>140/90), Obesity (Fat mass >30% or BMI >27.3 kg.m^2) and hyper-cholesterolaemia (>5.2 mmol.l^{-1}).

Fitness components

Table 6 shows the results for selected fitness parameters. The mean value of 23.5 for sit-ups per minute for the current subjects compares favourably with the 25.0 found by Andrews (1990) for South African females aged 18 to 55 years of age. The mean for modified push-ups is relatively low at 15.9 per 30 seconds.

TABLE 6. **MEANS AND STANDARD DEVIATIONS FOR, AND PREVALENCE OF SELECTED FITNESS COMPONENTS (N=243)**

Fitness component	**Mean ± standerd deviation**
Sit-ups in 1 minute	23.49 ± 8.11
Push-up in 30 seconds (supported on the knees)	15.87 ± 5.35
	Distribution (%)
Short calf muscles	51.44
Short hamstring muscles	16.87
Short hip flexor muscles	35.39
Inadequate shoulder ROM	14.4

More than 51% of the subjects had short calf muscles. This could be due to the tendency of females to wear shoes with elevated heels. The incidence of short hip flexors (35.9%) and short hamstrings (16.9%) could contribute to mechanical back pain (Coetsee, 1995). Special attention should be given to stretching exercises as a component of a well-balanced structural exercise programme.

CONCLUSION

Although the fitness and health profile of white females joining health and fitness clubs seems to be better than the general population of Durban, there is still much room for improvement. It is suggested that health and fitness service providers take note of these findings and implement effective measures in reducing the modifiable risk factors in their clients. In this way they will significantly contribute to the health status of the South African public.

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Prof. Marius F. Coetsee: Department of Human Movement Science, University of Zululand, Private Bag X1001, KwaDlangezwa 3886, Republic of South Africa. Tel.: +27 (0)35 902-6648 (w), +27 (0)35 772-6639 (h), Fax.: +27 (0)35 902-6428, E-mail: mcoetsee@pan.uzulu.ac.za

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