CHAPTER 3

METHODS AND PROCEDURES

3.1 METHODS

3.1.1 SUBJECTS

The subjects that participated in this study were originally 184 black African males, performing physical labour. Their mean age was 44,8 years and they were selected from a group of employees working at two specific departments, namely the ECAS (Escom Catering and Accommodation Services) and Security departments. The subjects were stratified randomly assigned to either a control group (n=92) or an experimental group (n=92). Fifty-eight subjects dropped out of the study. Thirteen went on early pension, 5 died of Aids and 40 subjects did not comply with the exercise programme or preferred to withdraw from the wellness programme due to their unique culture. Data is thus presented on an experimental group of 34 subjects compared to a age, gender and occupation matched control group of subjects. The experimental group was exposed to an intervention programme for half a year, while the control group subjects were requested to continue with their present lifestyles.

The department managers announced the availability of the programme. The programme was then explained to employees where they were invited to voluntarily enrol. It forms part of a total wellness drive in the company where the whole company will eventually be evaluated. The success of similar health promotion programmes led to the approval of the company to implement the programme throughout the company and make it available to all employees.

An informed consent was obtained from all subjects involved in the study (appendix A).

3.1.2 INSTRUMENTS

In completion of the evaluation of the subjects, the following instruments were utilised:

a) an ALPK2 aneroid sphygmomanometer was used in the indirect measurement of systematic arterial blood pressure.
b) a Sit-and-reach box was used to measure hamstring and lower back flexibility.
c) a John Bull skinfold calliper was used to determine the subject's fat %.
d) a Reebok step-up bench was used to determine the subject's physical fitness.
e) a Medical and health habits questionnaire was used to determine the subject's health and fitness status (appendix B).

3.2. PROCEDURES

The evaluation commenced with a questionnaire, signing of an informed consent, which led to the physical and clinical evaluation of the subjects. The medical and health habits questionnaire (appendix B) indicated the subject's medical and health status. The clinical and physical evaluation consisted of the following tests:

a) *Blood pressure*: A stethoscope and an aneroid sphygmomanometer were used in the indirect measurement of systematic arterial blood pressure. Each subject was seated with the arm and back supported with the arm at heart level when blood pressure was taken. Unless the first two readings varied by more than 5mm Hg, five readings, at least one minute apart, were taken to get an averaged reading (fig. 6).

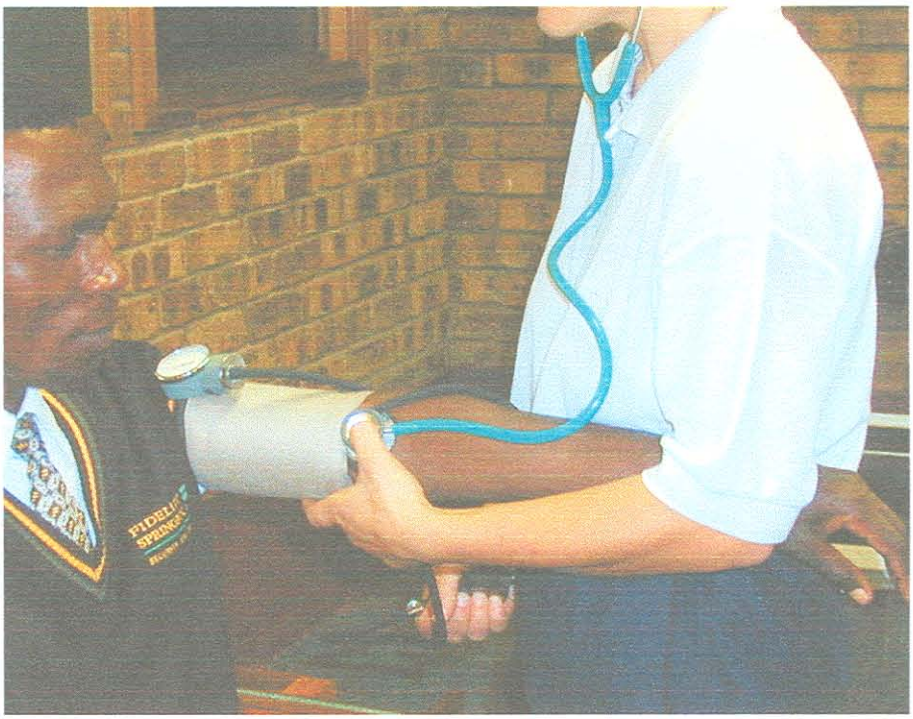

Figure 6: Blood pressure measurement.

b) *Sit-and-reach test*: A Sit-and-reach test was used primarily to determine the flexibility of the hamstring musculature, and secondarily the flexibility of the lower back. The subjects were seated on the floor with legs extended straight in front and against a 30,5 cm. high box with a measuring tape secured on top. The 50 cm. mark of the measuring tape should be at least at the edge of the box. The person then placed the index finger of both hands together and slowly reached forward as far as possible on the measuring tape, holding the position for 1 second. The score was the most distant point reached by the fingertips in the better of two trials. The knees had to be straight and in contact with the floor at all times. Bouncing into the stretch position was not allowed and the movement had to be slow and gradual (fig.7).

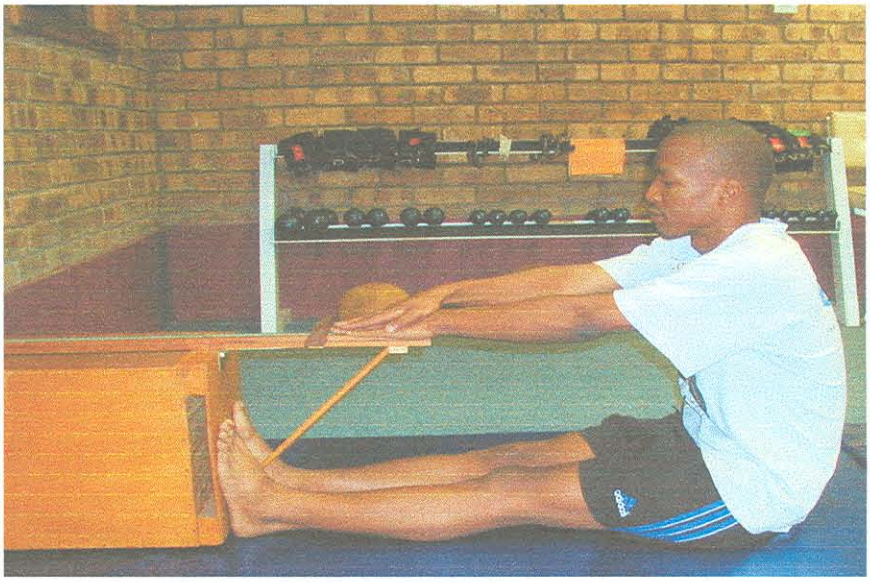

Figure 7: Hamstring and lower back flexibility test.

c) *Body fatness / Fat %:* A John Bull skinfold calliper was used to determine the subject's fat percentage. Test procedures for taking the three-skinfold measurements (pectoral, abdominal, thigh) were the adapted form used by Jackson & Pollack (1978). All measurements were taken on the right side of the body.

A short description of the three skinfold sites are as follow:

Pectoral /Chest

A diagonal fold taken one half of the distance between the anterior axillary line and the anterior axillary line and the nipple (fig. 8).

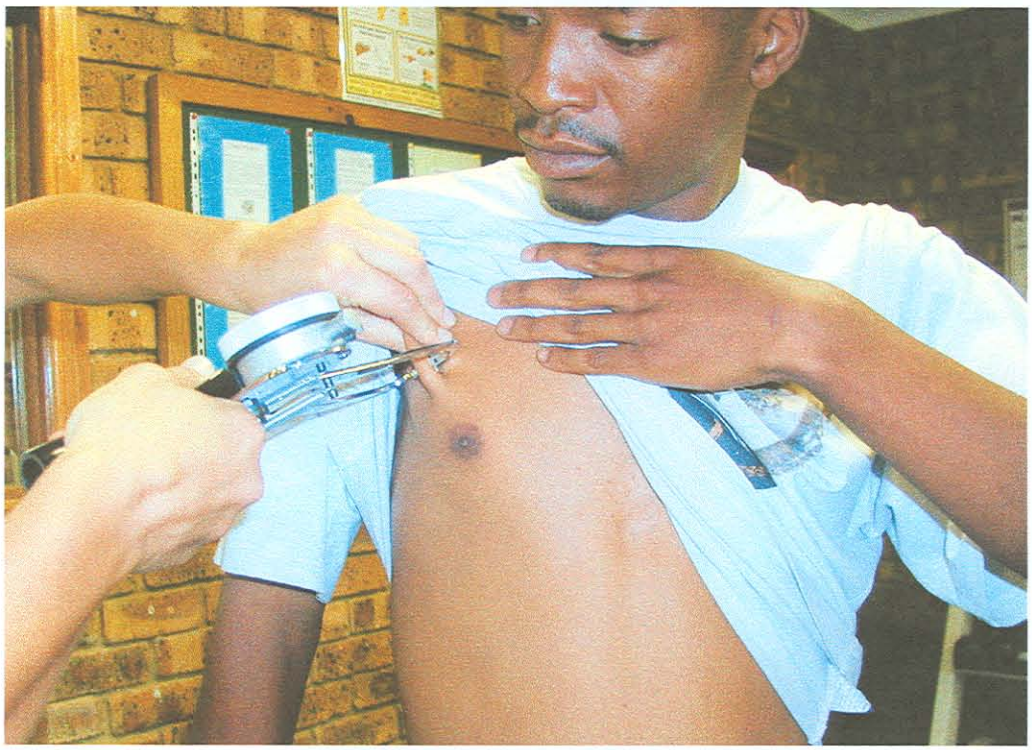

Figure 8: Pectoral/Chest measurement.

Abdominal

A vertical fold taken at a distance of 2 cm. to the right side of the umbilicus (fig. 9).

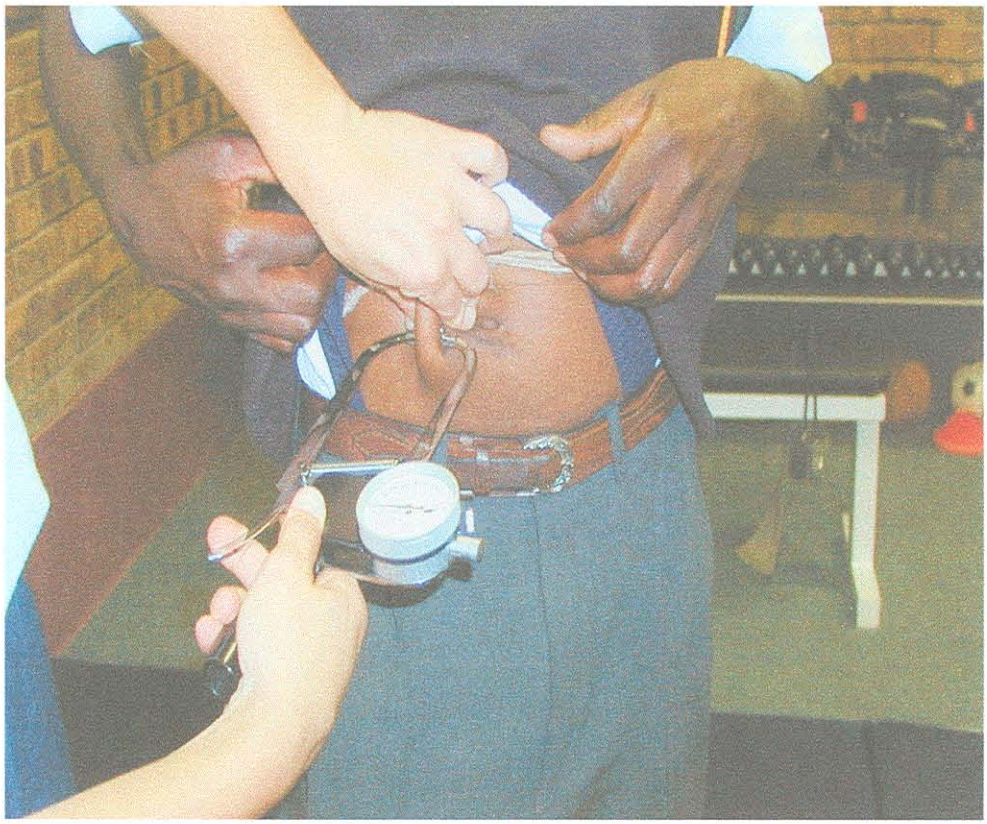

Figure 9: Abdominal measurement.

Thigh

A vertical fold on the anterior midline of the thigh, midway between the proximal border of the patella and the inguinal crease (hip) (fig. 10).

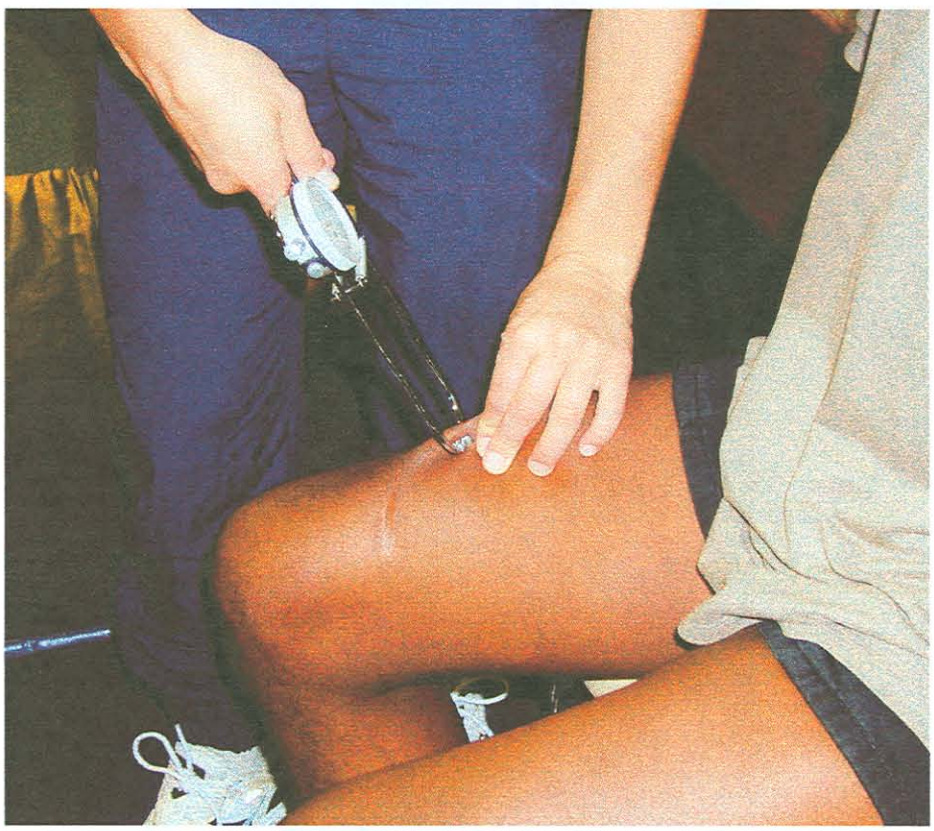

Figure 10: Thigh measurement.

d) *Physical fitness*: A 3-min. submaximal step test was used to determine the subject's physical fitness level. The subject's heart rate was taken immediately after exercise for 15 seconds (fig. 11).

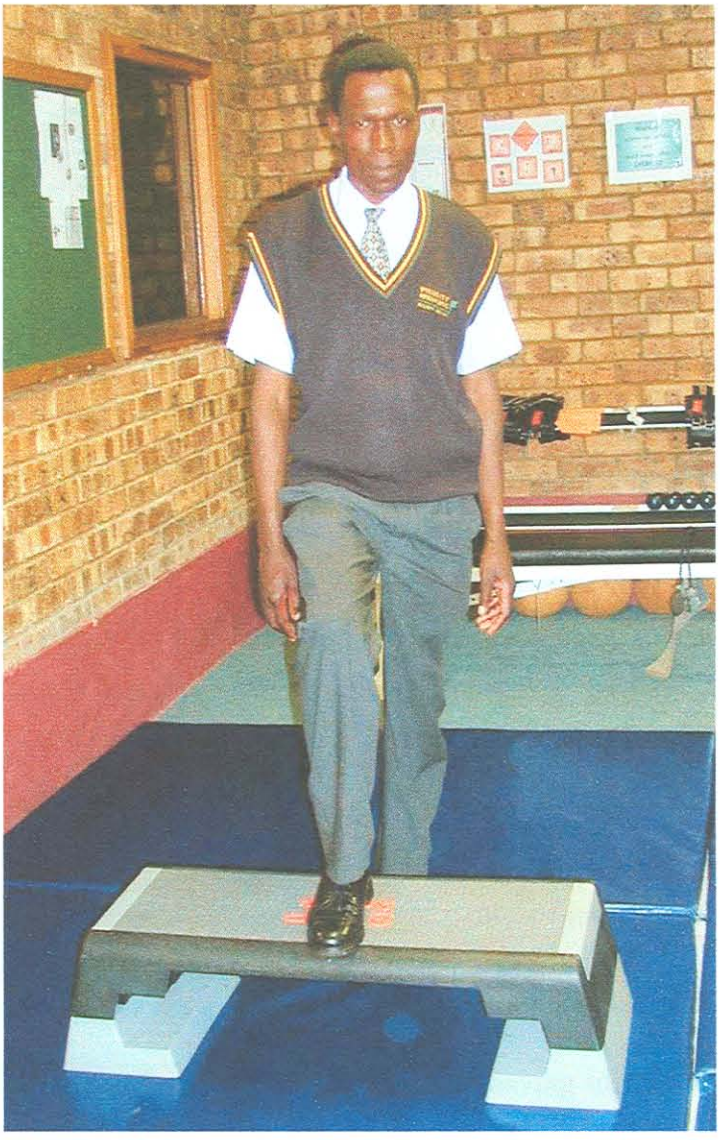

Figure 11: Fitness test.

Data concerning the subjects' medical and health status, sick leave and absenteeism, was gathered as follow:

f) *Medical and health habits questionnaire*: To be eligible for the physical and clinical screenings, each subject completed a medical and health habits questionnaire in order to determine their medical and health status (appendix B).

f) *Medical records*: The subject's medical records at the medical centre were used to obtain absenteeism and sick leave data.

3.3 STUDY DESIGN

This study was a typical experimental epidemiological study where an intervention (6-month physical wellness programme) was evaluated. It coincided with findings by Walter & Hart (1990) that listed the following relevant and important research areas that lend themselves to the application of a pyramidal hierarchy of epidemiological research strategies:

"1. Estimation of the prevalence and severity of injury and/or fatalities in the populations of exercising individuals and sportsmen - such as evaluating the type and frequency of musculoskeletal injury.

2. Identification of risk factors and high risk participants - such as studying the relationship of training and equipment to the injury rate, or intrinsic factors which may be predicative of injury; and finally

3. Development of preventative interventions - where having identified significant risk factors, modifications to reduce of morbidity or mortality are considered.

Epidemiological approaches can thus be classified into two categories: observational and experimental where the last mentioned typically entails the systematic evaluation of an intervention or preventative measure, by way of a randomised controlled trial (Van Heerden, 1996).

A true pre-test - post-test stratified randomised groups experimental design was adopted (Thomas & Nelson, 1990). The design was labelled as follows:

R	O1	T	O2
R	O3		O4

R: Stratified random assignment of subjects to groups.

O: Observation of test (subscripts refer to the order of testing; i.e. O1 is first time a test is given and O2 the second).

T: Treatment is applied; a blank space means that the group is a control.

The major purpose of this type of design was to determine the amount of change produced by the intervention (in this case the 6-month physical wellness programme), that is, did the experimental group change more than the control group. This design threatened internal validity of testing, but the threat was controlled, as the comparison of O3 and O4 in the control group includes the testing effect as well as the comparison of O1 to O2 in the experimental group. Thus, although the testing effect could not be evaluated, it was controlled (Thomas & Nelson, 1990).

Sick leave and absenteeism data were compared before intervention (6-months retrospectively) and during intervention (6-months prospectively).

3.4 MEASUREMENTS

Baseline and post-intervention data were compared. Evaluations done by the biokineticist and occupational health nurse included a physical and clinical screening as well as a medical and health habits questionnaire. The occupational health nurse did the clinical measurement of the participant's blood pressure and the biokineticist did the physical assessment of the participants flexibility, physical fitness (3 min. step test) and fat percentage (3 skinfold measurements). Sick leave and absenteeism data were obtained from the participant's medical files at the medical centre.

3.5 INTERVENTION PROGRAMME

The duration of the intervention programme was 6 months and started immediately after completion of the pre-test. The initial health education session was led by the occupational health nurse making him- or herself available for further consultation, if needed, on health concerns such as smoking cessation, diet, stress management and AIDS. At that time, the participants were informed of the findings and the level of their physical status. Any abnormalities or risk factors present were discussed and corrective measures were outlined. The multidisciplinary team was available for the duration of the study to deal with any health-related problem that might arise. Participants diagnosed with hypertension during the initial physical evaluation and health education session were advised to visit the medical centre once a week to have their blood pressure screened by the occupational health nurse for the remainder of the 6-month intervention programme.

A programme of gradually increasing cardiovascular/aerobic-, anaerobic- and stretching exercises, tailored to the individual's history and level of fitness, was prescribed. See appendix C for the prescribed exercise card. Each patient's programme was written on a programme card, with the re-evaluation date stipulated. The major emphasis was placed on improved cardiorespiratory fitness. The participants had the option to choose from four easy accessible types of cardiovascular exercise (cycling, walking, soccer and jogging). The reason for this was that their personal circumstances could impede them from having access to specialised exercise equipment. Almost the entire participants lived in the local single quarters, far from town, with no sport or recreational facilities close by. The anaerobic or strengthening exercises consisted of exercises where they could train against there own body resistance (sit-ups, push-ups, hip flexion, knee flexion, calf raises, tricep extension and hiplifts). Once again the reason for this was to make the programme as cheap and accessible possible for the participants which suited their personal circumstances. Each exercise session included a warm-up and cool-down phase where basic stretching exercises were performed (quadriceps-, hamstring stretching and a shoulder stretch). See appendix C for the prescribed stretching exercises. Each participant was asked to make a commitment to exercise at least three times a week with

a rest day in between, for a minimum period of 20 minutes, at a medium intensity for a duration of six months. Subjects assessed at high risk or with cardiovascular disease under a physician's care required clearance from their corporate physician.

The participant's exercise intensity was increased during the follow-up sessions 6 weeks after the initial physical screening/evaluation and immediately after the 12 weeks post-testing session. For the duration of the study the intensity of the participants' exercise programme was increased after every 6 week follow-up session, and another 6 weeks after each post-testing session. Feedback on each individual's results was given by the biokineticist immediately after completion of the physical and clinical screenings. Any complaints or adverse symptoms were evaluated and continuous participation was encouraged.

During the first week after the initial screening, a wellness workshop addressing all the wellness dimensions (social, spiritual, physical, occupational, environmental, emotional and intellectual) was presented to the participants. It formed part of the experimental group's intervention programme.

Exercise was performed on and off the premises. All activities were done in the employees' own time, outside of their flexible work schedule. The company offered no incentives for participation in the programme.

3.6 DATA PROCESSING AND STATISTICAL ANALYSIS

In any study where one uses subjects and the data obtained from these subjects is statistically analysed, it is important that the number of subjects and representative nature of the sample are taken into consideration. (Chen, 1991).

Ordinal data resulting from the questionnaire and some portions of the clinical examination was categorised into frequencies of findings. Differences between sets of ordinal data were evaluated using the Mann-Whitney U-test. Where the data was of a

ratio or interval nature, significant differences between the experimental and control group were evaluated by using an independent t-test (Thomas & Nelson, 1991). Due to the size of the two groups, it was decided to also report the ratio and interval data by using the Mann-Whitney U-test for two independent groups. Although this non-parametric statistical test is less powerful than the parametric independent t-test, it was chosen because it does not rely on parameter and/or distribution assumptions (Howell, 1992).

To determine whether significant relationships existed between the various aspects of the medical and health habits questionnaire and the number of absenteeism and sick leave days, cross-tabulations were used. Additional Chi-square tests were performed in order to determine whether the relationships between variables were statistically significant or not. Nsick tests were performed to determine the relationship between stress, low back pain, P C stress, sick leave and absenteeism.

Statistical analysis of the data also comprised of descriptive summary statistics (mean and standard deviations).

In all statistical analysis, the 95% level of confidence ($p \leq 0,05$) was applied as the minimum to interpret significant differences among sets of data (Thomas & Nelson, 1990). Computations to determine standard descriptive statistics (mean and standard deviation) and analysis of variance (t-test) and non-parametric analysis (Mann-Whitney U-test) were performed using the SPSS for MS Windows release 6.1.