THE EFFECTS OF LOW-IMPACT AEROBIC DANCE ON THE HEALTH-RELATED FITNESS AND SELF-CONCEPT OF FEMALE STUDENTS

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I declare that this dissertation describes my original work, except where specific acknowledgement is made to the work of others and has not been submitted for a degree to any other university.

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ABSTRACT

The purpose of this study was to examine the effects of low-impact aerobic dance on the health-related fitness and self-concept of female students at the University of Fort Hare. Thirty-seven subjects, aged 19 to 24 years, participated in a low-impact aerobic dance programme three times per week for 10 consecutive weeks. Each session was approximately 50 minutes long and the subjects exercised at 70 — 85% of their age predicted maximum heart rate. The subjects performed a battery of health-related fitness tests to measure cardiorespiratory and musculoskeletal functions and body composition. The psychological tests administered to the subjects were the Counselling Form of the Tennessee Self Concept Scale (Fitts 1965) and the Body Cathexis Scale (Secord and Jourard 1953). The subjects were pre-tested one week prior to beginning the training programme and post-tested within one week following the ten weeks of training.

Post-test results revealed significant improvements ($p < 0,01$) in all the components of health-related fitness. Cardiorespiratory fitness improved by 17,1%. Improvements in musculoskeletal function ranged from 4,0% for flexibility of the lower back and posterior thighs to 8,5% for leg power, 14,9% for the strength/mass ratio, 66,6% for abdominal muscular endurance and 185% for muscular endurance of the arms and shoulder girdle. Percentage body fat decreased by 2,0%. The results of the psychological tests revealed that the subjects scored significantly higher ($p < 0,01$) on seven of the nine subscales of the Tennessee Self Concept Scale. In the Body Cathexis test significant changes ($p < 0,01$ and $p < ,05$) occurred for 83% of the items on the scale. In the analysis of the relationship between self-concept and health-related fitness, none of the fitness components were significantly related to self-concept. It was concluded that participation in a low-impact

aerobic dance programme resulted in an improvement in health-related fitness and self-concept, but that there was no significant correlation between fitness and self-concept.

To my mother, Diana, and the memory of

my father, Narayansamy Pillay

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CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

The growth of passive forms of entertainment have negatively affected the physical well-being of modern people. Automation and technology have freed many from heavy physical work and manual labour (Simpson 1989). Exercise has become less necessary as a part of the normal work day of many adults, even though the need for regular exercise has not decreased (Corbin and Lindsey 1985). However, over the past twenty years there has been a worldwide upsurge in public awareness of the need for regular exercise in order to maintain optimum health (Balogun 1987). This has led to a dynamic "Physical Fitness" revolution in an attempt to counter the deleterious effects of hypokinesis resulting from the sedentary lifestyle of modern Western Society (Scott and Masipa 1990).

This growth in exercise awareness and participation has led to the popularization of a new form of physical activity, aerobic dance (Warrick and Tinning 1989a). In recent years aerobic dance has grown from a fitness fad into a legitimate form of exercise with an estimate of over 23 million participants (Koszuta 1986). The popularity and appeal of aerobic dance lies in its diversity as it incorporates exercise, various dance and movement forms and music. The movements combine rhythmn, grace, co-ordination and flexibility, and are ideally pursued without overstressing the body.

A number of aerobic dance training studies have been published. These were mainly conducted in the United States of America, beginning in the late 1970s. The majority of these investigations examined the changes in cardiorespiratory fitness (VO_{2max}) following a period of participation in aerobic dance. A growing file of literature exists that documents the cardiorespiratory benefits of aerobic dance (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Johnson *et al* 1984, Cearly *et al* 1984, Watterson 1984, Dowdy *et al* 1985, Williams and Morton 1986, Blessing *et al* 1987a, Blessing *et al* 1987b, Gillett and Eisenman 1987, Moore *et al* 1988, Williford *et al* 1988a, Ford *et al* 1989, McCord *et al* 1989, Parker *et al* 1989, Hopkins *et al* 1990). Changes in VO_{2max} from these aerobic dance training studies have revealed improvements ranging from 5% to 41% with a mean percentage increase of 12%.

In the early 1980s traditional aerobic dance found itself at the centre of controversy over the high injury rate (Garrick and Requa 1988). Traditional aerobic dance consists of a mixture of running, hopping, skipping, jumping, sliding and swinging movements and a variety of dance steps set to music. During the performance of these dance routines there is a suspension phase during which both feet are momentarily off the floor. Recently, a modification of traditional aerobic dance has evolved called "low-impact" aerobic dance. In this approach, one foot maintains contact with the floor at all times, thereby eliminating the suspension phase of the activity. The incidence of impact-type injuries associated with traditional aerobic dance could be lessened with low-impact aerobic dance (McCord *et al* 1989).

Four training studies have investigated the effects of low-impact aerobic dance on cardiorespiratory fitness and body composition (Gillett and Eisenman 1987, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990). No reported studies have looked at the effect of low-impact aerobic dance on the other component of health-related fitness: musculoskeletal function. With its increasing popularity it would be useful to determine if low-impact aerobic dance will enhance cardiorespiratory fitness like traditional high-impact aerobic dance does, in addition to establishing its effects on the other components of health-related fitness.

Physical fitness has generally been assumed to be important to mental health. A critical review of evidence supporting the positive relationship between physical fitness training and mental health variables has been evaluated by Folkins and Sime (1981). From an examination of 120 studies dealing with physical fitness and mental health these authors concluded that fitness training seemed to help people cope with psychological stresses and tended to promote general well being in the individual. Their review indicates that research has generally confirmed the assumption that fitness training improves self-concept.

Only six studies have been reported on the effects of aerobic dance on the psychological well-being of participants. Eickhoff *et al* (1983), Plummer and Koh (1987), Berryman-Miller (1988) and Ford *et al* (1989) investigated the effects of aerobic dance on self-concept, whereas Shifron (1983) and Watterson (1984) looked at related aspects such as vocational self-concept and the subjective evaluation of general well-being, respectively.

A unique psycho-social milieu exists in aerobic dance classes. As a recreational activity aerobic dance is group-based and non-competitive. The sport is enjoyed by varying age groups, and is equated with fitness, physique improvement and social interaction. Aerobic dance encourages camaraderie among participants and may be a stimulating and enjoyable avenue for self-expression and liberation from day to day pressures (Kenen 1987, Warrick and Tinning 1989a). Warrick and Tinning (1989a) also contend, however, that the sub-culture of aerobic dance, with its emphasis on body weight and shape control, could reinforce the cult of slenderness which for many women is a source of anxiety, frustration and oppression.

Considering the paucity of research that exists on the effects of low-impact aerobic dance on the health-related fitness and psychological well-being of participants, this study will focus on specific aspects in these areas.

1.2 STATEMENT OF THE PROBLEM

The purpose of this study was to determine the effects of low-impact aerobic dance participation on the health-related fitness and the self-concept of female students at the University of Fort Hare. Specifically, the various components of health-related fitness (cardiorespiratory and musculoskeletal functions and body composition) were measured to determine which were significantly affected by the ten week low-impact aerobic dance programme. The self-concept of the students was also measured before and after the programme to determine if any changes occurred. In addition, the relationship between the components of health-related fitness and self-concept was examined.

1.3 SIGNIFICANCE OF THE STUDY

It has been established that traditional high-impact aerobic dance is an appropriate mode of exercise to improve cardiorespiratory fitness (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Johnson *et al* 1984, Cearly *et al* 1984, Watterson 1984, Dowdy *et al* 1985, Williams and Morton 1986, Blessing *et al* 1987a, Blessing *et al* 1987b, Williford *et al* 1988a, Ford *et al* 1989, Parker *et al* 1989). However, a paucity of research presently exists concerning the cardiorespiratory benefits of low-impact aerobic dance (Gillett and Eisenman 1987, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990). In addition, Ford *et al* (1989) is the only reported aerobic dance study which looked at the effects on the other components of health-related fitness.

Although many studies have been conducted to determine the psychological implications of sport and exercise, a paucity of research exists on the effects of aerobic dance on self-concept (Eickhoff *et al* 1983, Plummer and Koh 1987, Berryman-Miller 1988, Ford *et al* 1989). Only two of these studies (Plummer and Koh 1987, Berryman-Miller 1988) showed significant improvements in the self-concept after participation in an aerobic dance exercise programme. The present study was conducted in an attempt to provide more information in this area.

1.4 DELIMITATIONS

- This study was delimited to 40 female students from the University of Fort Hare who volunteered to participate in a low-impact aerobic dance programme three times a week for ten consecutive weeks. These subjects agreed not to exercise outside of class time and not to change their eating habits.

- A battery of health-related fitness tests was administered to measure the three areas of physiological function that are related to health: cardiorespiratory and musculoskeletal functions and body composition.

- The pre- and post-tests were conducted one week before the commencement of the exercise programme and one week after the end of the programme, respectively.

- Recently compiled national physical fitness norms by Andrews(1990) were used for comparison. These normative tables were compiled using data from four population groups in the country, namely, asian, black, coloured and white.

1.5 LIMITATIONS

- Maximal oxygen uptake (VO_{2max}) was predicted using the Golding *et al* (1989) bicycle ergometer submaximal protocol, and not measured directly.

- The sum of triceps, subscapular and suprailiac skinfolds, as devised by Pollack *et al* (1980) was used to estimate the percentage body fat. These formuli were used as no local normative tables to estimate percentage body fat have yet been established. However, additional skinfold measurements were taken, namely, biceps, triceps, subscapular, abdomen and suprailiac, to compare with the national norms established by Andrews (1990).

1.6 HYPOTHESES

It was hypothesized that significant changes in health-related fitness and self-concept would occur as a result of participation three times per week for ten weeks in a low-impact aerobic dance programme. It was further hypothesized that the components of health-related fitness would correlate positively with self-concept.

1.7 TERMINOLOGY

Traditional / High-impact Aerobic Dance: The original aerobic dance programmes consist of an eclectic combination of various dance forms including ballet, modern, jazz, disco and folk, as well as callisthenics-type exercises including running, hopping, skipping, jumping, stretching and gravity-assisted strengthening exercises. During the performance of these dance routines there is a suspension phase of the body during which both feet are momentarily off the floor.

Low-impact Aerobic Dance: Similiar to traditional high-impact aerobic dance, except it employs movements where at least one foot is on the floor at all times, thereby eliminating the suspension phase of the activity.

Aerobic Dance: All forms of aerobic dance, including the traditional / high-impact and low-impact forms.

Body-Cathexis: The degree of feeling of satisfaction or dissatisfaction with the various parts or processes of the body.

Tennessee Self Concept Scale (TSCS) Definitions of Scores (Fitts 1965)

Self Criticism Score: This score consists of mildly derogatory statements which most people admit as being true of themselves. Those who deny most of the statements most often are being defensive, making a deliberate effort to present a favourable picture of themselves.

Total Positive Score: This score reflects the overall level of self-esteem. Those with high scores tend to like themselves, feel they are persons of value and worth, have confidence in themselves and act accordingly.

Identity: This consists of "what I am" items. People describe their basic identity — what they are as they see themselves.

Self Satisfaction: This score consists of items which describe how a person feels about the self they perceive. In general it reflects the level of self satisfaction or self acceptance.

Behaviour: Derived from items which say, "this is what I do or this is the way I act," this score measures people's perception of their own behaviour or the way they function.

Physical Self: Here people present their view of their bodies, state of health, physical appearance, skills and sexuality.

Moral-Ethical Self: This score describes the self from a moral-ethical frame of reference — moral worth, relationship to God, feelings of being a "good" or "bad" person, and satisfaction with one's religion or lack of it.

Personal Self: This score reflects the sense of personal worth, people's feeling of adequacy and evaluation of their personality apart from their body or relationship to others.

Family Self: This score reflects feelings of adequacy, worth, and value as a family member. It refers to people's perception of self with reference to their closest and most immediate circle of associates.

Social Self: This is another "self as perceived in relation to others" category, but pertains to "others" in a more general way, reflecting a sense of adequacy and worth in social interaction with others.

CHAPTER 2

REVIEW OF RELATED LITERATURE

This chapter is a review of the current literature on aerobic dance with special emphasis on low-impact aerobic dance. The specific topics that will be covered include the origin and development of aerobic dance, a discussion of the traditional and low-impact aerobic dance training studies and related research, and the psychological aspects related to aerobic dance.

2.1 AEROBIC DANCE

2.1.1 Background to Aerobic Dance

Aerobic dance traces its origins to Jacki Sorenson who began conducting exercise classes at a USA Navy base in Puerto Rico in 1969 (Schuster 1979). Within two years aerobic dance was integrated into the YMCA exercise programmes in South Orange, New Jersey and has since grown prolifically throughout the United States of America and the rest of the world. Studies have shown that it is one of the most popular fitness activities with estimates of more than 23 million adult participants (Koszuta 1986).

The growth of aerobic dance has been stimulated by the production of audio- and video-taped dance exercise programmes, as well as an inexhaustive number of permutations of the original dance exercise format. Beginning in 1982 with the original "Workout" video and audio tapes by Jane Fonda, this option for the home-bound aerobic dancer now encompasses scores of programmes from a variety of sources including physicians, exercise physiologists, entertainment personalities, professional athletes and former aerobic dance students (Garrick and Requa 1988).

The original aerobic dance programmes consisted of an eclectic combination of various dance forms including ballet, modern, jazz, disco and folk, as well as callisthenics-type exercises including running, hopping, skipping, jumping, stretching, and gravity-assisted strengthening exercises. Innovations to the original aerobic dance programmes include water aerobic dance done in a swimming pool, low-impact aerobic dance employing movements where at least one foot is on the floor at all times, specific aerobic dance programmes staying in the confines of a particular dance form such as ballet or jazz, and assisted aerobic dance where weights are worn on the wrists and/or ankles while performing the exercises (Garrick and Requa 1988). A more recent innovation is step aerobics which utilizes a step or bench to rhythmically raise and lower the body's centre of gravity and increase the intensity of the exercise. While difficult to document, it would appear that aerobic dance has captured the interests of a large group of individuals. Most of these are women, many of whom have failed to previously embrace any other form of structured fitness activity (Garrick and Requa 1988).

In South Africa there is no national controlling body for aerobic dance and hence no statistics are available to gauge the status or popularity of the sport. At present eight aerobic dance organizations are affiliated to the Southern African Association for Exercise Science and Fitness. This association is concerned with exercise and health, the development of norms for physical fitness, the development and assessment of fitness programmes, resistance training, aerobic and anaerobic exercise, rehabilitation, research and training. The eight aerobic dance organizations are: The South African Trimgym Association, The South African

Gymnasium and Exercise Leaders Federation, Fit Gym, Health and Beauty Exercise, Fitco, Biotrim, Keep Fit International and The South African National Aerobics Association. Each organization conducts their own accreditation and certification programmes for instructors. These have all been evaluated and approved by the Southern African Association for Exercise Science and Fitness. These organizations have a number of instructors, health clubs and gymnasiums affiliated to them. However, when approached in 1993, none of these organizations could provide data on their exact membership number. In addition to these eight organizations, other aerobic dance organizations with no professional affiliation also exist.

The South African Trimgym Association is in the process of compiling a national register of qualified instructors in aerobic dance. However, this task is hampered because each aerobic dance organization administers and evaluates its own accreditation and certification programmes for instructors. Some aerobic dance organizations have no professional affiliation and there is no national controlling body overseeing the control of standards.

A number of international exercise videos are currently on sale in South Africa. These include videos by Cindy Crawford, Britt Ekland, Jane Fonda, Jerry Hall, Dolph Lundgren and Lizzie Webb. However, the local GMSA Body Beat series by Wally Green and Linda Kriel is in great demand (Friedrich 1993). South Africa's World Amateur Aerobics Champion Chris Botha said "In recent years, there has been a definite increase in aerobics and gym-ing. South Africa is also becoming more exposed to international competition. The noticeable effect has been a higher level of professionalism. Six years ago anyone could just go and teach. Nowadays you won't get work at a gym unless you have the appropriate qualification from a recognised organisation" (Friedrich 1993, p. 14). According to Irving (1988) aerobic dance classes have enriched the quality of life of thousands of South Africans. However, the author felt it was the responsibility of all those who participated in such classes to ensure that the exercises were done correctly and safely. Also, education of both the instructor and the student would increase the pleasure of this form of exercise.

2.1.2 Aerobic Dance Research

A. Traditional aerobic dance

A number of aerobic dance training studies have been published. These were mainly conducted in the United States of America, beginning in the late 1970s. The majority of these investigations examined the changes in cardiorespiratory fitness (VO_{2max}) following a period of participation in aerobic dance.

When comparing investigations into aerobic dance, discretion should be exercised. Aerobic dance is unique in that the subject's training workload cannot be objectively and absolutely prescribed. The dance exercise routines, the length of the training period, the frequency, intensity, duration, and the fitness level of subjects vary from study to study and can affect the training outcomes (Williford *et al* 1989).

One of the earliest training studies (Rockefeller and Burke 1979) documented the results of ten weeks of thrice weekly aerobic dance classes performed by a group of 21 untrained female college students, aged from 19 to 24 years. Each class lasted approximately 40 minutes and consisted of one warm-up dance, six to seven aerobic dance routines and one cool-down dance. They noted a statistically significant ($p < 0{,}01$) improvement in VO_{2max}, maximal pulmonary ventilation, submaximal heart rate and submaximal perceived exertion. There was a 13% improvement in VO_{2max}, from 34,38 $ml.kg^{-1}.min^{-1}$ to 38,79 $ml.kg^{-1}.min^{-1}$, while the body mass of the subjects remained unchanged.

Vaccaro and Clinton (1981) examined the effects of 10 weeks of aerobic dance conditioning (three 45 minute sessions per week) on the body composition and maximal oxygen uptake of college women ranging in age from 19 to 27 years. They found a significant improvement ($p < 0,05$) in VO_{2max} from 31,11 $ml.kg^{-1}.min^{-1}$ to 38,24 $ml.kg^{-1}.min^{-1}$. This increase of 7,13 $ml.kg^{-1}.min^{-1}$ represents a 23% change in VO_{2max} following training. This study revealed a slight, but non-significant increase in percentage body fat from a pre-training value of 26,57% to a post-training value of 27,20%. The authors indicated that it was not readily apparent why aerobic dance failed to reduce changes in body fat. However, it was felt that the short duration of training would not have allowed possible effects to become manifest. In addition the subjects were within the optimal range of percentage body fat (20% — 27%) and were requested not to practice dietary control, which could also have resulted in the failure to modify body composition in a positive direction (Vaccaro and Clinton 1981).

A comparative study on the cardiorespiratory changes between an aerobic dance programme and a jogging programme in untrained college-aged women was done by Milburn and Butts (1983). Both the aerobic dance and jogging groups exercised for four 30-minute sessions per week for seven weeks. An 8 — 10 minute warm-up period preceded the 30-minute training session for each group. The aerobic dance routines were performed as continuously as possible with an average of six to seven routines completed during each 30-minute session. A continual walk-jog combination was initially used for the joggers until they were able to jog continuously for the entire training period. The results indicated that both the aerobic dancers and joggers increased their VO_{2max} values significantly ($p < 0,05$), from 35,4 $ml.kg^{-1}.min^{-1}$ to 39,0 $ml.kg^{-1}.min^{-1}$ (10,2%) and from 36,4 $ml.kg^{-1}.min^{-1}$ to 39,4 $ml.kg^{-1}.min^{-1}$ (8,2%), respectively. Significant decreases ($p < 0,05$) in maximal heart rates of 2,9 and 2,8 beats per minute were found for the joggers and dancers, respectively. The results of this study indicated that both jogging and aerobic dance could result in similar cardiorespiratory improvements if performed at similar training intensities, frequencies and durations. In addition, many of the subjects found aerobic dance a mode of exercise more attractive, less monotonous and more conducive to creativity and variety than jogging.

Johnson *et al* (1984) employed both a two- and a three- day per week training design in an effort to evaluate and compare changes in maximum oxygen uptake and body composition between these two groups. Both groups exercised at 70% of their pre-training maximum heart rates for twelve weeks. However, the total exercise duration in this study was congruently maintained between the groups during the training period. Both groups progressed by five-minute increments so that by week 12 the two-day per week subjects were exercising for 45 minutes and the three-day per week subjects were exercising for 30 minutes. Therefore, although the frequency of the exercise was dissimilar, the total amount of time spent performing aerobic dance was 90 minutes per week for both groups. The two-day per week group elicited an increase in VO_{2max} of 11% (39,5 to 43,8 $ml.kg^{-1}.min^{-1}$) whereas the three-day per week exercisers showed a similar, but slightly lesser increase of 9% (42,6 to 46,6 $ml.kg^{-1}.min^{-1}$).

The effects of two- and three-day per week aerobic dance programmes on maximal oxygen uptake was further investigated by Cearly *et al* (1984). Eighteen college students who enrolled in an aerobic dance class were randomly assigned to the two- or three-day per week groups. Seven subjects in each group finally completed the 10 week study. Training sessions for each group were identical and consisted of 10 — 15 minutes of warm-up calisthenics followed by continuous aerobic dance to music, and were concluded with five to 10 minutes of cool-down activities. The aerobic dance phase began with fifteen minutes of continuous dance routines at an intensity of 75% of maximal heart rate and progressively increased to 30 minutes by the sixth week of training. The results indicated that VO_{2max} improved significantly from pre- to post-testing in the three-day per week subjects. They showed an 11% improvement, from 40,1 to 44,5 $ml.kg^{-1}.min^{-1}$. There was a non-significant

5% improvement in VO_{2max} shown by the two-day per week group. The data in this study support the contention that aerobic dance provides a useful means of enhancing cardiorespiratory fitness in college-aged females. However, in order to achieve significant benefits from such programmes, aerobic dance training sessions should be conducted at least three days per week.

Watterson (1984) studied the effects of a six week aerobic dance programme on the cardiovascular fitness of 16 subjects between the ages of 22 and 44 years. They participated in two supervised and one unsupervised one-hour dance sessions a week for six weeks. Each dance session began with a 15-minute warm-up followed by seven to eight dance routines. Each dance routine was at least three minutes long and alternated with one-minute recovery periods of walking. Each subject was taught how to take her carotid pulse and told what her target heart rate zone was (70% to 85% of the predicted maximal heart rate). The predicted maximal heart rate was computed as 220 beats per minute minus the age of the subject in years. The results indicated a significant improvement ($p < 0,01$) on the distance covered in Cooper's 12-minute field test, and a significant decrease ($p < 0,01$) of three to four beats per minute in the resting heart rates of the dance groups. In addition, a subjective questionnaire indicated that the members had fun and were well motivated throughout the study.

Dowdy *et al* (1985) documented the results of 10 weeks of thrice weekly aerobic dance classes on the physical work capacity, cardiovascular function and body composition of women with a mean age of 32 years. Each 45-minute workout consisted of approximately seven minutes of warm-up dance, 30 minutes of conditioning dance routines and eight minutes of cool-down dance. The exercise intensity for the conditioning phase of the workouts was prescribed at between 70% and 85% of the heart rate reserve. There was a significant increase ($p < 0,05$) in maximal ventilation (8%), oxygen uptake (6%) and treadmill test time (16%). Measures of VO_{2max} improved less in this study, from 33,8 ml.kg^{-1}.min^{-1} to 35,7 ml.kg^{-1}.min^{-1} (6%) than in the previous studies discussed. The type, intensity, duration and frequency of the aerobic dance used for conditioning in this study were very similar to those in studies by Rockefeller and Burke (1979), Vaccaro and Clinton (1981) and Milburn and Butts (1983). Dowdy *et al* (1985) noted that the initial VO_{2max} of the subjects (33,8 ml.kg^{-1}.min^{-1}) was similar to that in the previous aerobic dance studies on college women (31 ml.kg^{-1}.min^{-1} — 36 ml.kg^{-1}.min^{-1}) (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Cearly *et al* 1984), even though the subjects were on average approximately 10 years older. If it is assumed that VO_{2max} would decline approximately 0,5 ml.kg^{-1}.min^{-1} per year between the ages of 21 and 31 years (Drinkwater *et al* 1975, Hodgson and Buskirk 1977), the initial VO_{2max} of the subjects in this study would have been expected to be lower than in the younger women by approximately 5 ml.kg^{-1}.min^{-1}. Relatively high initial VO_{2max} values, approximately equal to the younger women used in previous studies, suggest that the women in the study by Dowdy *et al* (1985) possessed a higher initial level of fitness relative to their age.

Also, in the study by Dowdy *et al* (1985), neither body mass nor any of the body composition measures were altered by aerobic dance. These authors concluded that aerobic dance performed for 30 — 45 minutes, three days a week over a 10 week period significantly increases physical work capacity and improves cardiovascular function. However, without dietary control aerobic dance does not alter body composition in sedentary young middle-aged women.

The cardiorespiratory and body composition changes in 25 sedentary females, aged 18 to 30 years, following 12 weeks of aerobic dance training was evaluated by Williams and Morton (1986). The training undertaken consisted of three 45 minute sessions per week. This study also incorporated a new aerobic dance protocol that was designed to satisfy the needs of many aerobic dancers. These needs included: (1) greater continuity within the exercise session by modification of the arrangement of dance routines; (2) less frequent recovery periods; and (3) the inclusion of a number of routines incorporating movements, other than those executed in a standing position, that are aerobic in nature and promote an increase in muscle strength in specific areas of the body. The results indicated that VO_{2max} showed a significant increase ($p < 0,01$) of 16% from 35,3 $ml.kg^{-1}.min^{-1}$ to 40,8 $ml.kg^{-1}.min^{-1}$. Small, but significant increases ($p < 0,01$) in body density and lean body mass were also obtained.

Blessing *et al* (1987a) studied the effects of 10 weeks of aerobic dance participation (three 45 minute sessions per week) on the cardiorespiratory endurance and body composition of 22 college-age women aged between 18 and 22 years. Approximately five minutes of warm-up and cool-down exercise, were provided at the beginning and end of each session. The exercise intensity for the conditioning phase of the workouts was prescribed at between 70% and 85% of the age predicted maximal heart rate. A significant increase ($p < 0,05$) in VO_{2max} of 16,2% was obtained. The changes in body mass, fat mass, and lean body mass were not significant. However, a significant decrease ($p < 0,05$) was found in percentage body fat.

The physiological effects of eight weeks of aerobic dance with and without hand-held weights was investigated by Blessing *et al* (1987b). Training sessions consisted of three 45 minute sessions per week. The hand-held weights group exercised with a one pound (0,45 kg) weight in each hand for five minutes during the first week. Five minutes per week were added until 20 minutes of continuous exercise was performed using the weights. The exercise intensity for the conditioning phase of the workouts was prescribed at between 70% and 85% of the age predicted maximal heart rate. The changes in VO_{2max} for the hand-held weights group (37,7 to 42,6 $ml.kg^{-1}.min^{-1}$) and non hand-held weights group (36,5 to 41,9 ml.kg^{-1}.min^{-1}) were 12,9% and 14,7%, respectively. No change in body mass or body composition occurred in this study. The authors concluded that cardiovascular fitness and body composition are not significantly different between hand weight users and non-users. They suggested that more favourable benefits may be associated with a longer accommodation period for holding the weights and a concomitant increase in the amount of weight being held during training.

Williford *et al* (1988a) documented the results of 10 weeks of thrice weekly aerobic dance classes performed by a group of 10 untrained female college students with a mean age of 23 years. The training sessions consisted of five to 10 minutes of warm-up and stretching, 30 minutes of aerobic dance at 60% to 90% of heart rate reserve and concluded with a seven minute cooldown period. Williford *et al* (1988a) noted a statistically significant ($p < 0,05$) improvement in VO_{2max} of 12%, from 34,7 to 38,9 ml.kg^{-1}.min^{-1}. No significant changes occurred in body mass, percentage body fat, lean body mass or fat mass.

The effects of an eight-week aerobic dance programme performed for three 40 minute sessions per week was documented by Parker *et al* (1989). They studied the effects on the maximal oxygen uptake and body composition of 14 subjects with a mean age of 19 years. No significant changes were observed in body mass, percentage body fat, or lean body mass. However, a significant difference ($p < 0,05$) was found in VO_{2max} with an 11% increase from 34,4 to 38,1 ml.kg^{-1}.min^{-1}.

The only reported study to investigate the effects of aerobic dance on health-related fitness was conducted by Ford *et al* (1989). They investigated the effects of eight weeks of aerobic dance (3 one hour sessions per week) on four health-related fitness tests which tested cardiorespiratory fitness (step test), muscular endurance (one-minute sit-up test), flexibility (sit-and-reach), and body composition (percentage body fat). The post-test scores indicated significant differences between the aerobic dance group and the control group regarding the one-minute sit-up test and the sit-and-reach test. No significant differences were found in the other tests. According to Ford *et al* (1989), the lack of significant treatment effects could have been the function of a variety of factors. Firstly, the eight-week training period, with three days of participation each week, may have been insufficient to engender widespread physical changes. Secondly, assessment of the extracurricular physical activity of the control group indicated that they were physically active during the study.

"Does aerobic dance offer more fun than fitness? Is it fitness, or socializing to music?" (Legwold 1982, p. 147). According to Legwold (1982) many critics have questioned the intensity of traditional aerobic dance and its value as a modality for cardiovascular training. The training studies on traditional high-impact aerobic dance clearly demonstrate improvements in cardiorespiratory fitness as measured by VO_{2max}. These increases range from 5% to 23%, with a mean percentage increase of 11%. Thus it was felt that traditional aerobic dance was a suitable alternative for those people who found jogging and cycling unattractive (Schuster 1979).

B. Low-impact aerobic dance

In the early 1980s traditional aerobic dance found itself at the centre of controversy over the high injury rate. Concerns regarding the injuries were both theoretical and objective. The theoretical concerns stemmed from two issues. Firstly, early programmes were conceived by individuals with little or no background in medicine, kinesiology or exercise physiology. Secondly, some of the activities and postures utilized in the choreography were generally considered "harmful" by the medical or kinesiology communities. The more objective concerns arose when physicians began treating patients with musculoskeletal complaints arising from participation in aerobic dancing (Garrick and Requa 1988).

A few studies have examined the injury potential of aerobic dance. Francis *et al* (1985), Richie *et al* (1985) and Mutoh *et al* (1988) utilized questionnaires to elucidate injury histories in a retrospective manner. Garrick *et al* (1986) studied a group of aerobic dancers for 16 weeks by maintaining weekly contact.

In the study conducted by Francis *et al* (1985), 103 of 135 instructors (76%) reported that they had sustained or aggravated a total of 220 injuries as a result of their aerobic dance participation. In this study the term "injury" was never defined. Using the average exposure data presented in the report, an injury rate of 0,22 injuries was sustained per 100 hours of exposure.

Richie *et al* (1985) analysed questionnaires from 1 233 students and 58 instructors. An injury was defined as "any condition causing significant pain and/or limiting participation". Among the students, 543 (43,3%) reported 1 075 injuries. Fourty-four (75,9%) instructors reported 105 injuries. One hundred (9,3%) of the student injuries and 30 (28,6%) of the instructors' injuries required treatment by a physician. The calculated injury rate was 1,01 per 100 hours of participation for the students and 0,29 injuries per 100 hours of participation for the instructors.

Garrick *et al* (1986) recruited 351 students and 60 instructors for their study. Exposure and injury data were collected by means of weekly telephone contacts over a period of 16 weeks. If the injury resulted in no activity attenuation or disability it was classified as a Grade I injury. Grade II injuries resulted in alteration or cessation of aerobic dance, but not to activities of daily living. Grade III injuries resulted in an alteration of normal daily activities as well as those associated with aerobic dance. Grade IV injuries were those for which professional medical assistance was sought. Among the students, 155 (44,1%) reported 244 injuries, while 45 (75%) of the instructors reported 83 injuries. The majority of injuries sustained by students (74,6%) and instructors (72,3%) were Grade I injuries. Six students (2,5%) and one instructor (1,2%) required formal medical assistance. The injury rate was 1,16 and 0,93 per 100 hours of activity for students and instructors, respectively.

Mutoh *et al* (1988) surveyed 800 students and 161 instructors from 13 Japanese fitness facilities. An injury was defined as "any condition that causes significant pain and/or limits participation". Results showed an injury rate of 22,8% for students and 72,4% for instructors. The number of injuries per 100 hours of aerobic dance was 0,15 for students and 0,17 for instructors.

Garrick and Requa (1988) indicated that these statistics on aerobic dance injuries do not justify the criticism levelled against the sport. They indicated that it was difficult to condemn as inordinately hazardous an activity that resulted in an injury severe enough to require medical attention only once in every 4 275 hours of participation (Garrick *et al* 1986) or even once during 1 092 hours (Richie *et al* 1985).

The lower extremities accounted for more than 80% of all injuries (Macintyre *et al* 1984, Francis *et al* 1985, Garrick 1985, Richie *et al* 1985, Garrick *et al* 1986, Mutoh *et al* 1988). Among the lower extremity injuries, the leg (including the shin, calf and Achilles' tendon) was the most frequently injured anatomic part (Macintyre *et al* 1984, Francis *et al* 1985, Richie *et al* 1985, Garrick *et al* 1986, Mutoh *et al* 1988). Foot and knee injuries were reported more commonly than ankle problems (Macintyre *et al* 1984, Garrick 1985, Francis *et al* 1985, Richie *et al* 1985).

A typical traditional aerobic dance class is approximately 45 to 60 minutes long. It consists of a warm-up and stretching period, an aerobic period, a conditioning period, and a cooling down and stretching period. During the aerobic period, running on the spot frequently is done to increase the intensity of the exercise. In running, the mechanical stresses are absorbed by the heels, whereas in aerobic dance, the loads are absorbed by the forefoot, and the stress on the lower legs is greater than in running (Mutoh *et al* 1988). This, according to Mutoh *et al* (1988) was one of the main problems of traditional aerobic dance.

Irving (1988) stated that the principle causes of aerobic dance injuries were: overuse as repetitive stress of soft tissue and bone creates microtrauma which could lead to muscle tears, tendonitis or stress fractures; muscle imbalances and flexibility as the inflexible person had an increased predisposition to muscle tears when stressing parts of the body in unfamiliar ways; and improper training of instructors and poor technique, particularly when utilizing exercises which cause the lower back to arch, hard surfaces and improper footwear. Irving (1988) further proposed the following solutions: instructor training, using an additional instructor who could move around the class and correct alignment faults or modify exercises to suit individual needs; the grading of classes into beginners, intermediate and advanced; self monitoring by participants and well designed and choreographed programmes. In addition, the author advised participants that "pain should be regarded as a reminder that the body is being damaged and it should be treated with respect, not ignored" (Irving 1988, p. 12).

According to Williford *et al* (1989) one of the preventative methods of injuries in aerobic dance is low-impact aerobic dance. Low-impact aerobic dance reduces the amount of impact shock claimed to be associated with injuries in traditional aerobic dance. Low-impact movements are not ballistic like those that make up high-impact aerobic dance. Instead, they consist of large upper body movements with a wide range of motion. These arm movements, performed above the level of the heart, are combined with low kicks, high-powered steps and side-to-side movements and lunges. The assumption behind the low-impact aerobic dance approach is that the combination of jumpless dance steps and shoes designed specifically for aerobic dance will reduce the impact shock on muscles and joints (Koszuta 1986). The low-impact aerobic dance training studies (Gillett and Eisenman 1987, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990) reported no injuries sustained during the studies.

Harnischfeger *et al* (1988) investigated the incidence of injury following high- and low-impact aerobic dance versus running. Forty-nine college age females were divided into the three different training groups. Subjects trained for eight weeks, four times a week, for 30 minutes a day. Heart rate monitoring was employed to determine exercise intensity during training. Post-training VO_{2max} values, as measured by treadmill and arm ergometer testing, did not change significantly for any of the groups as a result of the eight-week training programme. Injury frequency and severity were evaluated using a weekly questionnaire. One subject indicated an injury which resulted in discomfort, but did not alter her exercise regimen. Four subjects each indicated an injury that required medical attention. After the first two weeks, the mean weekly range of severity in high-impact aerobic dance injuries (1,01 to 1,6) was significantly higher than the mean weekly range for low-impact aerobic dance injuries (0,01 to 0,8) and running injuries (0,2 to 0,9). Harnischfeger *et al* (1988) concluded that the observed changes in the incidence and severity of injury indicated low-impact aerobic dance and running were less injurious forms of exercise compared to high-impact aerobic dance.

Research has shown traditional high-impact aerobic dance to be an appropriate mode of exercise to improve physical fitness and performance. Improvements in cardiorespiratory fitness (VO_{2max}) have ranged from 5% to 23%.

Testimonials by instructors suggest that low-impact aerobic dance is as demanding as high-impact aerobic dance and that the same physiologic benefits can be derived from either method (Koszuta 1986). However, a paucity of data presently exists concerning the training outcome of low-impact aerobic dance. Only four training studies (Gillett and Eisenman 1987, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990) have been reported. Also, Gillett and Eisenman (1987) and Moore *et al* (1988) felt that low-impact aerobic dance may elicit training effects which are not parallel to outcomes revealed with the traditional high-impact style.

For women previously trained with high-impact aerobic dance, low-impact aerobic dance may not be sufficiently demanding as a training alternative to maintain maximal aerobic power. Moore *et al* (1988) reported a significant increase ($p < 0,05$) of 28,0 to 29,4 $ml.kg^{-1}.min^{-1}$ in maximum oxygen uptake and a decrease in percentage body fat of 29,2% to 27,7% following 12-weeks of weighted low-impact aerobic dance in a group of previously sedentary women. The aerobic component of the training programme consisted of 20 — 30 minutes, four days per week, at a prescribed intensity of 75% to 85% of maximum heart rate reserve. All subjects wore one pound (0,45kg) wrist weights. However, after following the same low-impact programme, a second experimental group, consisting of females who had previously been high-impact exercisers, showed a significant ($p < 0,05$) 6,6% decrease (37,8 to 35,3 $ml.kg^{-1}.min^{-1}$) in VO_{2max} and an increase (67 to 68kg) in body mass. Moore *et al* (1988) concluded that low-impact aerobic dance may be a suitable training activity for sedentary individuals with low initial fitness levels, but may not allow for maintenance of aerobic capacity and/or normal body mass in those trained in high-impact aerobic dance.

Gillett and Eisenman (1987) studied the effect of intensity controlled low-impact aerobic dance on middle-aged, overweight women. They reported a rise in maximum aerobic power which surpasses other training studies documented. Low-impact aerobic dance resulted in a 41% improvement of these subjects' maximum oxygen consumption. However, the length of the training period was longer (16 weeks) than the mean for the other studies reviewed (10 weeks). Furthermore, these subjects exhibited notably lower initial measures of aerobic power (22,5 $ml.kg^{-1}.min^{-1}$) compared to the mean of 35,7 $ml.kg^{-1}.min^{-1}$ for participants in the other aerobic dance training studies reviewed. Finally, Gillett and Eisenman (1987) incorporated an acutely monitored training paradigm representative of individualised exercise prescription which was not employed in the other training investigations.

The exercise format used by Gillett and Eisenman (1987) consisted of 15 minutes of warm-up, 12 — 23 minutes of cardiovascular work, four minutes of aerobic cooldown, 15 minutes of strengthening exercises and six minutes of stretching and relaxation. The class began with 12 minutes of cardiovascular work at 60% of each individual's maximum heart rate reserve. This relatively low initial exercise intensity was selected on the basis of the group's low initial VO_{2max} values. Exercise intensity was self-monitored by participants using carotid pulse palpitation during each exercise interval. Intensity of effort was also self-controlled due to dyspnea, muscular soreness and muscle fatigue resulting from lactic acid accumulation, and the mechanical stress of the weight-bearing activity. The duration and intensity of the cardiovascular work progressed gradually over the 16 week period from 12 to 15 minutes during the first eight weeks and from 15 to 23 minutes during the second eight weeks. At the beginning of week eight the participants were instructed to work at 70% — 80% of their maximum heart rate reserve. Exercise intensity was controlled by regulating the duration of the intervals between exercise segments. Group activity during these intervals consisted of rapid walking for 30 — 40 seconds during the initial four weeks. This was gradually decreased to 20 seconds by week eight, thereby increasing the intensity of the workout without greatly increasing the exercise time. Intervals were reduced to 15 seconds by week 16 at which stage the group was exercising at the same intensity and duration as the control group.

The control group in this study demonstrated a 22% increase in VO_{2max}. These subjects followed a less supervised aerobic dance programme with no individualised progression, typical of those conducted in commercial fitness centres. The exercise format for the control group was similar to that of the experimental group. The time interval between exercise segments did not exceed 15 seconds. During these relief intervals the class walked rapidly around the aerobic dance floor. Neither the format nor the exercise intensity varied for the control group during the 16 weeks. Participants were instructed to exercise so that their heart rate was 70% — 80% of their heart rate reserve and to maintain this intensity for twenty minutes.

In this study, (Gillett and Eisenman 1987), control of the intensity and the use of a discontinuous training format were two important factors that seemed to contribute to the marked increase in VO_{2max} in the experimental group. The use of intensity-controlled exercise tailored to the fitness level of the participants can result in larger positive changes in cardiovascular fitness in a population of middle-aged, over-weight women than an aerobic dance programme that does not vary in intensity.

A study of the effect of low-impact aerobic dance on the functional fitness of elderly women with a mean age of 65 years was undertaken by Hopkins *et al* (1990). After participating in three 50-minute exercise sessions per week for a duration of 12 weeks, the functional fitness of the experimental group improved significantly ($p < 0,01$), whereas that of the control group deteriorated. The results indicated increases in the experimental group of 62% in strength/endurance, 13% in cardiorespiratory endurance, 13% in agility, 12% in balance, 9% in flexibility and a 5% decrease for the sum of skinfolds. Motor control and coordination decreased by 2%. After 12 weeks of inactivity, the control group deteriorated 4% in cardiorespiratory endurance, 6% in motor control and coordination and 3% in agility. No significant changes were identified in flexibility, strength/endurance, balance and the sum of the three skinfolds. Without intervention, it appears that elderly sedentary women continue to decline in functional fitness. This study has demonstrated one of the positive aspects of low-impact aerobic dance in that it can be a safe and beneficial form of exercise for elderly sedentary people.

McCord *et al* (1989) examined the effects of a 12 week programme of low-impact dance conditioning on VO_{2max}, submaximal heart rate and body composition of college-aged females. This is the only reported training study of low-impact aerobic dance conducted on college-aged subjects. Training took place three days per week for 12 consecutive weeks. Each session lasted 45 minutes and began with a five to 10 minute warm-up segment followed by 20 — 35 minutes of low-impact aerobic exercise. The duration of the aerobic phase increased gradually throughout the 12 weeks with a 35 minute phase occurring in the 11th and 12th weeks. A 5 — 10 minute cool down period followed the exercise phase. For the first two weeks subjects trained at 70 — 75% of their maximum heart rate reserve. Thereafter, subjects were encouraged to maintain a training heart rate equal to 75 — 85% of their pre-test maximum heart rate reserve.

Post-test results in the McCord *et al* (1989) study revealed a small (7%) but significant increase ($p < 0,05$) in VO_{2max} (38,3 $ml.kg^{-1}.min^{-1}$ to 41,3 $ml.kg^{-1}.min^{-1}$). It should be noted, however, that the pre-training mean VO_{2max} in this study was considerably higher than values reported for untrained college females in other aerobic studies (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Blessing *et al* 1987a, Blessing *et al* 1987b, Williford *et al* 1988a). It has been suggested by Ekblom *et al* (1968) that the relative improvement in VO_{2max} with training is inversely related to an individual's initial

VO_{2max}. The relative increase in VO_{2max} in this study is similar to that reported by other aerobic studies which utilized high-impact aerobic dance as a mode of training and where the pre-training VO_{2max} of college-aged students was similarly high (Cearly *et al* 1984, Johnson *et al* 1984). Thus, McCord *et al* (1989) concluded that the relative improvement in aerobic capacity varied with the training intensity, frequency and duration, as well as the initial VO_{2max}, rather than the particular mode of training, provided it is cardiovascular in nature. Two other findings worth noting from this study were the high rate of compliance and lack of injury during the training programme. Over the 12 week period there was no subject dropout and no injuries. Group attendance was maintained above 90% for the duration of the study.

In view of the fact that there are only four reported low-impact aerobic dance training studies (Gillett and Eisenman 1987, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990), more investigation is needed on the training effects of low-impact aerobic dance. Three low-impact aerobic studies used middle-aged and elderly subjects (Gillett and Eisenman 1987, Moore *et al* 1988, Hopkins *et al* 1990). Only one of the four studies (McCord *et al* 1989) used college students where a very small improvement in VO_{2max} (7%) was documented. This is well below the mean attained in the traditional aerobic studies using college students (12%) (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Cearly *et al* 1984, Johnson *et al* 1984, Blessing *et al* 1987a, Blessing *et al* 1987b, Williford *et al* 1988a, Parker *et al* 1989). Hence more research is needed on the training effects of low-impact aerobic dance on college students.

C. General research

The initial research into aerobic dance was in the form of energy cost studies of Weber (1974), Foster (1975) and Igbanugo and Gutin (1978). As indicated in Table 1 (p. 30) the mean exercise VO_2 ranged from a low of 12,79 $ml.kg^{-1}.min^{-1}$ (Igbanugo and Gutin 1978) for low intensity traditional aerobic dance to a high of 39,40 $ml.kg^{-1}.min^{-1}$ (Otto *et al* 1986) for high-impact aerobic dance. Foster (1975) replicated the findings of Weber (1974) for high intensity aerobic dance routines, reporting a mean VO_2 of 33,60 $ml.kg^{-1}.min^{-1}$. At this intensity traditional aerobic dance is comparable to jogging at an 8,9km/h pace or to performing other activities which require an energy output of eight to nine METS. Based on these findings, traditional aerobic dance was shown to elicit a moderately high energy cost suitable for a viable cardiorespiratory training stimulus (Williford *et al* 1989).

In terms of total caloric expenditure for a traditional 30-minute aerobic dance session, the approximate expenditure of 240 kcal (Weber 1974) and 237 kcal (Rockefeller and Burke 1979) were first reported. Additionally, Rockefeller and Burke (1979) estimated that, including the warm-up and cool-down segments, an entire 40-minute session of aerobic dance elicits an expenditure of 289,3 kcal. Nelson *et al* (1988) predicted that a 50-minute dance exercise session would require 317 kcal.

Greater clarity in interpreting aerobic dance energy expenditure can be derived by considering the dance exercise method (Table 2). The energy costs of the continuous low intensity, low-impact routines of Williford *et al* (1988b) (4,93 kcal/min) are similar in energy requirement to the interval low intensity routines of Weber (1974) (3,8 kcal/min) and Igbanugo and Gutin (1978) (4,06 kcal/min). The aerobic dance routines which generally require the greatest energy demand are "high intensity" high-impact routines (Williford *et al* 1988b) and high-impact routines (Claremont *et al* 1986, Otto *et al* 1988). The associated energy costs have been reported to range from 10,44 kcal/min (Williford *et al* 1988b) to 11,17 kcal/min (Claremont *et al* 1986). This metabolic load represents approximately 10 to 10,5 METS and is comparable to running at a 9,6 km/h (Williford *et al* 1988b).

Table 1: **Energy Cost Studies**

Study	Type of Dance	Mean Load (VO_2) $ml.kg^{-1}.min^{-1}$	Energy Expenditure kcal/min	Mets
Weber (1974)	High Intensity	28 – 32	8,8	8 – 9
	Medium Intensity	21	6,2	6
	Low Intensity	13,8	3,8	3,9
Foster (1975)		33,6	NR	9,6
Igbanugo and Gutin (1978)	High Intensity	27,25	8,59	7,8
	Medium Intensity	20,90	6,57	5,9
	Low Intensity	12,97	4,06	3,7
Rockefeller and Burke (1979)		26,54	NR	7,6
Claremont *et al* (1986)	High Intensity	34,65	11,17	
	Medium Intensity	33,35	10,71	
	Low Intensity	24,60	7,91	
Otto *et al* (1986)	High-impact	31,40	NR	8,9
	Low-impact	25,10	NR	7,0
Conerly and Smith (1988)	Low-impact (hand-held weights)	37,40	NR	10,7
	Low-impact	34,72	NR	9,9
Otto *et al* (1988)	High-impact	39,4	10,6	11,25
	Low-impact, multidirectional	25,10	10,7	11,28
Williford *et al* (1988b)	High-impact			
	High Intensity	37,18	10,44	10,6
	Low Intensity	31,68	8,82	9,0
	Low-impact			
	High Intensity	29,12	8,08	8,3
	Low Intensity	17,55	4,93	5,0
Yoke *et al* (1988)	Low-impact (hand-held weights)	36,1	9,7	10,3

NR Not Recorded

Otto *et al* (1986) were the first to compare low-impact aerobic dance with the traditional high-impact form. As indicated in Table 2 (p. 37), their data demonstrated that low-impact routines, choreographically and musically matched to high-impact routines, produced a significantly lower workload for low-impact (25,1 $ml.kg^{-1}.min^{-1}$) and high-impact aerobic dance (31,40 $ml.kg^{-1}.min^{-1}$).

These findings were replicated by Williford *et al* (1988b), using a similar design of four routines, two high-impact and two low-impact. These were matched for music and choreography. The high-impact aerobic dance routines produced a significantly greater energy expenditure (37,18 and 31,68 $ml.kg^{-1}.min^{-1}$) than either of the low-impact routines (29,12 and 17,55 $ml.kg^{-1}.min^{-1}$). Otto *et al* (1986) and Williford *et al* (1988b) both reported that similar heart rates can be produced for low-impact and high-impact aerobic dance in the absence of similar simultaneous metabolic requirements. Specifically, the high-impact, low intensity aerobic dance reported by Williford *et al* (1988b) elicited the same mean relative heart rate response as the low-impact, high intensity routine. Both dance styles required the subjects to exercise at approximately 83% of the maximum heart rate reserve. The mean relative metabolic load was significantly greater (8,8 kcal/min compared to 8,0 kcal/min) for the high-impact, low intensity routine. Williford *et al* (1988b) concluded that although high-impact routines produced the greatest energy expenditure, it may be too demanding and inappropriate for untrained individuals. Furthermore, low-intensity, low-impact aerobic dance may be insufficient to improve cardiovascular fitness and weight loss. Therefore, persons performing low-impact aerobic dance should maintain a fairly high level of intensity to expend an amount of energy similar to that associated with traditional, high-impact aerobic dance.

Otto *et al* (1988) demonstrated that "multi-directional" low-impact aerobic dance can require a cost of 10,7 kcal/min, which is similar to stationary high-impact dance. This low-impact style requires continual translatory movements of the participant across a four to five metre diameter.

Aerobic dance with 0,45kg hand-held weights has not been shown to increase energy expenditure significantly in excess of values reported for other non-weighted aerobic dance routines. The mean exercise VO_2 for reported studies were 34,72 $ml.kg^{-1}.min^{-1}$ without handheld weights and 37,40 $ml.kg^{-1}.min^{-1}$ with handheld held weights (Conerly and Smith 1988) and 36,1 $ml.kg^{-1}.min^{-1}$ with hand-held weights (Yoke *et al* 1988).

Body mass changes were investigated in thirteen aerobic dance studies. Only two studies (Johnson *et al* 1984, Williams and Morton 1986) found significant changes in body mass following training. Johnson *et al* (1984) reported a significant decrease in body mass ($p < 0,05$) of 74,3kg to 73,0kg. However, Williams and Morton (1986) reported a significant increase ($p < 0,01$) in body mass from 60,8kg to 62,1kg. This was attributed to a significant increase in lean body mass.

Of the 12 studies which investigated changes in percentage body fat, only six reported significant changes as a result of aerobic dance participation (Johnson *et al* 1984, Williams and Morton 1986, Blessing *et al* 1987a, Moore *et al* 1988, McCord *et al* 1989, Hopkins *et al* 1990). In the study by Johnson *et al* (1984) percentage body fat as determined by hydrostatic weighing, decreased from 36% to 34% in the two-day per week group and from 29% to 26% in the three-day per week group. However, the initial percentage body fat values in this study were much higher than those reported in the majority of aerobic dance investigations (mean 25%). Several of these subjects were described by the authors as "obese", with body fat percentages of some participants exceeding 40%. This may be one explanation for the favourable changes in body composition found in this study, but not demonstrated in others.

Three additional training investigations which employed the hydrostatic weighing technique observed a significant reduction in measures of percentage body fat (Williams and Morton 1986, Blessing *et al* 1987a, McCord *et al* 1989). Williams and Morton (1986) reported a significant alteration in body composition following 12 weeks of aerobic dance training three times a week. The percentage body fat dropped from 28,3% to 27,3%. However, this effect was due to a mean increase in the total body mass of 1,3kg due to a concomitant increase in lean body mass which exceeded the decrease in percentage body fat. The authors explanation of the relatively large increase in lean body mass was that a strength training stimulus in the form of a number of progressive resistance exercises was included in the programme. These exercises utilized the subjects' and a partner's body mass to provide resistance to static and dynamic muscle contractions. Blessing *et al* (1987a) also reported a statistically significant change ($p < 0,05$) in percentage body fat which reflected a decrease from 24,3% to 23,0%. The training programme consisted of three 30 minute sessions over 10 weeks. McCord *et al* (1989), in the only low-impact study to employ the hydrostatic weighing technique, reported a decrease in body fat from 25,2% to 21,2%. This was a considerably greater decline than reported by other studies for traditional aerobic dance training in which subjects also exercised at a frequency of three times a week for a duration of 12 weeks. This study found no change in body mass at the end of the training period. The subjects' body mass and percentage body fat were considered average with a mean body mass of 60 kg and 25% body fat. These subjects thus underwent significant body composition changes without a change in body mass, despite their average initial values (McCord *et al* 1989).

Two training investigations, Moore *et al* (1988) and Hopkins *et al* (1990), also observed significant changes in percentage body fat, using skinfold measurements. Moore *et al* (1988) reported a percentage body fat decrease from 29,2% to 27,7%, while Hopkins *et al* (1990) reported a sum of skinfold changes from 73mm to 69mm. Both of these studies were low-impact aerobic dance studies conducted with middle-aged and elderly subjects with mean ages of 45 and 65 years, respectively.

Studies by Vaccaro and Clinton (1981), Dowdy *et al* (1985), Williford *et al* (1988a), and Parker *et al* (1989), used the hydrostatic weighing method of body composition analysis. They found no significant changes in percentage body fat following aerobic dance training. Ford *et al* (1989), using skinfold measurements, also found no significant changes after eight weeks of aerobic dance training. A low-impact aerobic dance study by Gillett and Eisenman (1987) found a small but non-significant change in body mass and percentage body fat using bioelectrical impedance.

One explanation for the apparent failure of aerobic dance to consistently elicit significant favourable changes in body composition may be the short term nature of the investigations which did not allow these effects to become manifest (Katch *et al* 1969, Wallace 1975, Smith and Stransky 1976). Furthermore, in all the studies the subjects agreed not to exercise outside of class time and not to change their eating habits. It has been shown that generally, subjects within the optimal range of percentage fat (20% to 27%) who do not practice strict dietary control during training fail to modify body composition in a positive direction (Katch *et al* 1969).

D. Summary

Aerobic dance is unique in that workloads cannot be objectively and absolutely prescribed for subjects to adhere to during training. However, the training protocols, namely, the length of the training period, the frequency, intensity and duration of the exercise session, as well as the fitness levels of the subjects, vary from study to study and can affect training outcomes. Table 2 highlights the similarities and differences in the thirteen traditional high-impact and four low-impact aerobic dance studies. Below is a summary of the training protocols used in the reported studies.

i. Sample size

The sample sizes used in the 17 aerobic studies reviewed (Table 2) ranged from seven to 30 with a mean of 15. Only nine studies (Rockefeller and Burke 1979, Cearly *et al* 1984, Watterson 1984, Dowdy *et al* 1985, Williams and Morton 1986, Gillett and Eisenman 1987, Williford *et al* 1988a, McCord *et al* 1989, Hopkins *et al* 1990) reported the subject dropout rate. These ranged from 0% to 23%, with a mean of 11%. Watterson (1984), Dowdy *et al* (1985) and McCord *et al* (1989) had no subject dropout at all. There seems to be no information on whether high-impact aerobic dance studies are more conducive than low-impact aerobic dance studies to participants dropping out of aerobic dance programmes.

ii. Subjects

Ten studies reviewed used college students as subjects (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Johnson *et al* 1984, Cearly *et al* 1984, Blessing *et al* 1987a, Blessing *et al* 1987b, Williford *et al* 1988a, Ford *et al* 1989, McCord *et al* 1989). Three low-impact studies (Gillett and Eisenman 1987, Moore *et al* 1988, Hopkins *et al* 1990) used middle-aged and elderly subjects with mean ages of 42, 45 and 65 years, respectively. Only one of the four studies on low-impact aerobic dance used college students

(McCord *et al* 1989). All the studies used female, sedentary subjects, except Moore *et al* (1988) who investigated the effects of low-impact aerobic dance on eight high-impact aerobic dance trained subjects.

iii. Frequency

The mean number of sessions for the aerobic studies under review was three times per week. Two investigations can be identified which departed from the traditional three-day per week aerobic dance model. Cearly *et al* (1984) evaluated aerobic dance training performed two-days a week as opposed to three-days a week. The three-day a week group exhibited an 11% increase in VO_{2max}, while the two-day a week subjects yielded a 5% increase in VO_{2max}. Johnson *et al* (1984) also employed a two- and three-day a week design in an effort to evaluate changes in maximum oxygen uptake and body composition. In contrast to the findings of Cearly *et al* (1984), the two-day a week group elicited an increase in VO_{2max} of 11% ($p < 0,01$), whereas the three-day a week group improved significantly ($p < 0,01$) by 9%. However, Johnson *et al* (1984) indicated that the percent changes in the two-day a week group may have been in part a reflection of their lower initial VO_{2max}, 3 $ml.kg^{-1}.min^{-1}$ lower than the mean VO_{2max} for the three-day a week group, and their 7,1% higher level of body fat than the three-day a week group. It has frequently been noted that greater VO_{2max} changes can be expected from subjects with a lower initial fitness and/or a high percent body fat (Ekblom *et al* 1968). Also, unlike Cearly *et al* (1984), total exercise duration in the study by Johnson *et al* (1984) was congruently maintained between the groups during the training period. Both groups progressed in five minute intervals so that by week twelve the two-day a week group was exercising for 45 minutes and the three-day a week group was exercising for 30 minutes. Therefore, although the frequency of exercise was dissimilar, the total amount of time spent performing aerobic dance was 90 minutes a week for both studies.

Table 2: **Comparison of aerobic dance training studies**

Reference	No. of Subjects	Age (years)	Frequency (days/ week)	Duration of Study (weeks)	Change VO_{2max} (ml/kg/min)
Traditional Aerobic Dance Studies					
Rockefeller and Burke (1979)	21	19 — 25	3	10	13% (34,4 — 38,8)
Vaccaro and Clinton (1981)	10	21	3	10	23% (31,1 — 38,2)
Milburn and Butts (1983)	15	21	4	7	10% (35,4 — 39,0)
Cearly *et al* (1984)	7 7	21 20	2 3	10 10	5% (36,9 — 38,7) 11% (40,1 — 44,5)
Johnson *et al* (1984)	12 11	25 24	2 3	12 12	11% (39,5 — 43,8) 9% (42,6 — 46,6)
Watterson (1984)	16	22 — 44	3	6	14% inc in Coopers 12 — min. run
Dowdy *et al* (1985)	18	32	3	10	6% (33,8 — 35,7)
Williams and Morton (1986)	25	18 — 30	3	12	16% (35,3 — 40,8)
Blessing *et al* (1987a)	22	18 — 24	3	10	13% (32,8 — 37,2)
Blessing *et al* (1987b)	13	20	3	8	15% (36,5 — 41,9)
Williford *et al* (1988a)	10	23	3	10	12% (34,7 — 38,9)
Ford *et al* (1989)	21	19	3	8	15% (36,3 — 41,9)
Parker *et al* (1989)	14	19	3	8	11% (34,4 — 38,1)
Low-Impact Aerobic Dance Studies					
Gillett and Eisenman (1987)	20 18	42 42	3 3	16 16	41% (22,5 — 31,4) 22% (24,7 — 30,1)
Moore *et al* (1988)	11 8	45 45	4 4	12 12	5% (28,0 — 29,4) -7% (37,8 — 35,3)
McCord *et al* (1989)	16	17 — 29	3	12	7% (38,3 — 43,3)
Hopkins *et al* (1990)	30	65	3	12	13% inc. in half mile walk test

iv. Duration

The studies ranged in duration from 7 to 16 weeks, with 11 studies continuing for 10 to 12 weeks. According to the guidelines for exercise testing and prescription of the American College of Sports Medicine (1991) the most significant conditioning effects may be observed during the first six to eight weeks of the exercise programme. However, the short-term nature of these investigations may be one explanation for the reported failure of aerobic dance to consistently elicit significant favourable changes in body composition, as discussed previously.

The length of the exercise sessions ranged from 30 to 60 minutes, with 10 of the 16 studies (62,5%) employing 45 minute long sessions. Generally, each session comprised of a warm-up of five to 15 minutes, an aerobic phase of 20 to 35 minutes and a cool-down phase of five to 15 minutes.

v. Intensity

Vaccaro and Clinton (1981) and Ford *et al* (1989) were the only two studies not to report on exercise intensity. In the other studies heart rate was used to prescribe and monitor exercise intensity. Subjects were taught how to monitor their pulse at either the radial or carotid sites. The pulse was counted for 10 (or 15) seconds at specific intervals during the aerobic phase of the session (usually the middle) and multiplied by six (or four) to obtain their exercise heart rate per minute.

Two methods were used to calculate the training heart rate zone. In the first method, the training heart rate zone was calculated at between 70% and 85% of maximum heart rate (Milburn and Butts 1983, Cearly *et al* 1984, Johnson *et al* 1984, Watterson 1984, Blessing *et al* 1987a, Blessing *et al* 1987b, Hopkins *et al* 1990). The maximum heart rate was either obtained from the treadmill pre-test or estimated (220 minus the age of the subject). In the second method the training heart rate zone was calculated at between 70% and 90% of heart rate reserve, where heart rate reserve is the difference between maximum heart rate and resting heart rate (Rockefeller and Burke 1979, Dowdy *et al* 1985, Williams and Morton 1986, Gillett and Eisenman 1987, Moore *et al* 1988, Williford *et al* 1988a, McCord *et al* 1989, Parker *et al* 1989). Both methods are acceptable according to the guidelines for exercise testing and prescription by the American College of Sports Medicine (1991).

vi. Changes in VO_{2max}

The changes in VO_{2max} as a result of aerobic dance training ranged from 5% to 41%, with a mean percentage increase of 12%. It should be borne in mind that the aerobic dance routines, the length, the frequency, intensity and duration of the training period, and the fitness level and age of subjects varied from study to study and could have affected the results. The mean percentage increase in VO_{2max} of the traditional aerobic dance studies was 11%, as opposed to the mean increase of 19% reported for the low-impact aerobic dance studies. However, the mean increase of 19% in the low-impact aerobic dance studies could be over-inflated by the 41% improvement obtained by Gillett and Eisenman (1987) which incorporated an acutely monitored training paradigm representative of individualised exercise prescription, which was not employed in the other training investigations. Excluding the 41% improvement obtained by Gillett and Eisenman (1987), the mean percentage improvement for the low-impact aerobic dance studies decreases to 11%. This is comparable with the mean of the traditional aerobic dance studies.

Moore *et al* (1988) is the only reported study to record a decrease in VO_{2max}. VO_{2max} decreased from 37,8 ± 6,0 $ml.kg^{-1}.min^{-1}$ to 35,3 ± 4,9 $ml.kg^{-1}.min^{-1}$ following 12 weeks of low-impact aerobic dance in subjects previously trained in high-impact aerobic dance. They concluded that low-impact aerobic dance may not allow for the maintenance of aerobic capacity in those trained in high-impact aerobic dance.

In summary, aerobic dance is a popular form of exercise that appeals to many people, particularly women, more than other forms of aerobic exercise such as jogging, cycling or swimming (Dowdy *et al* 1985). The benefits of aerobic dance have been documented by the reported studies. These studies have shown that aerobic dance is an activity which fulfils the criteria set down in the American College of Sports Medicine Position Stand (1990) for developing and maintaining cardiorespiratory and muscular fitness:

- the mode of activity can be any that uses large muscle groups, can be maintained continuously, and is rhythmic in nature,
- the duration of the exercise should be between 20 minutes and 60 minutes of continuous aerobic exercise,
- the intensity of the exercise should be between 60% and 90% of maximum heart rate and,
- the frequency of exercise is recommended at three to five days a week.

2.2 PHYSICAL FITNESS AND PSYCHOLOGICAL WELL-BEING

2.2.1 Introduction

"Mens sana in corpore sano", a healthy mind in a healthy body, has been a wise saying through most of recorded history; it is a philosophy long synonymous with physical activity. Hippocrates, hailed as the father of medicine, is known to have prescribed exercise for patients suffering from mental illness. Plato, the Greek philosopher, advised people to avoid exercising either mind or body without the other, and thus preserve a healthy balance between them (Dishman 1986).

Physical exercise has become increasingly popular and much research describing the psychological benefits of improvements in physical fitness has emerged from a variety of settings. Physical educators, exercise physiologists, psychologists, rehabilitation counsellors, psychiatrists and physicians have all addressed this issue with some degree of optimism (Folkins and Sime 1981). The following definition of physical education further emphasizes the mental and emotional aim of physical education:

> Physical education, an integral part of the total education process, is a field of endeavour that has as its aim the development of physically, mentally, emotionally and socially fit citizens through the medium of physical activities that have been selected with a view to realizing these outcomes (Bucher 1979, p. 22).

McEwan and Andrews (1988) elaborate on the contribution of physical education to emotional development. They suggest that it should provide:

- enjoyment, relaxation from stress and attainment of mental health and self-confidence, the provision of scope for self-expression,
- control and expression of emotional behaviour, acquisition of self-discipline and the ability to cope with stress situations, and
- the development of positive attitudes towards the self, to others and to healthy physical activity with a view to the adoption of a healthy lifestyle.

A panel of the American National Institute of Mental Health, comprising of individuals with extensive clinical and research experience in mental health and exercise science, formulated the following consensus statements on the role of physical activity and mental health (Morgan 1985):

- Physical fitness is positively associated with mental health and well-being.
- Exercise is associated with the reduction of stress emotions such as state anxiety.

- Anxiety and depression are common symptoms of failure to cope with mental stress, and exercise has been associated with a decreased level of mild to moderate depression and anxiety.
- Long-term exercise is usually associated with reductions in traits such as neuroticism and anxiety.
- Severe depression usually requires professional treatment, which may include medication, electroconvulsive therapy, and/or psychotherapy, with exercise as an adjunct.
- Appropriate exercise results in reductions in various stress indices such as neuromuscular tension, resting heart rate, and some stress hormones.
- Current clinical opinion holds that exercise has beneficial emotional effects across all ages and in both sexes.
- Physically healthy people who require psychotropic medication may safely exercise when exercise and medications are titrated under close medical supervision.

These consensus statements indicate that there was agreement on the positive relationship between physical fitness and mental health.

Both theorists and clinicians in the field of mental health have accredited self-esteem as the most accessible index of emotional adjustment and mental health (Sonstroem 1982, Fox 1988). Self-esteem is generally regarded as the evaluative dimension of a person's self-concept with the result that the two terms are often used interchangeably (Wells and Marwell 1976). Kinch (1963, p.481) offers a general theory of self-concept, "The individual's conception of himself emerges from social interaction and, in turn, guides or influences the behaviour of that individual". The following are implicit in most considerations of the self-concept which take this stance and are suggested as basic postulates of the theory (Stein 1987):

- People's self-concept is based on their perception of the way others are responding to them.
- People's perception of the responses of others towards them reflect the actual responses of those others.

"Self theory is strongly phenomenological in nature and based upon the general principle that man reacts to his phenomenal world in terms of the way he perceives this world" (Fitts *et al* 1971, p.3). They state that the most salient feature of this world is the self as seen and experienced by the individual. Thus, self-concept is learned through experiences with oneself and with others. When self-perception has occurred and meanings and values are assigned to oneself, an ability is developed to view oneself in the same manner as one looks at the rest of the world.

According to Fitts *et al* (1971), self theory holds that the self-concept is a frame of reference from which people interact with their world. The self-concept is viewed as a link between observable behaviour and the underlying processes of the individual and is felt to be a directing force in all behaviour (Snodgrass 1977).

Self-concept is a human attribute that must be achieved. It is not given. General agreement exists that self-concept does not exist at birth (Fitts *et al* 1971). Its development begins soon after birth and continues throughout life, although it is thought to be relatively stable by the age of 11 or 12 years. However, development of the self-concept is an ongoing process throughout life (Snodgrass 1977), and there is considerable evidence that it may be changed by significant experience (Fitts 1965).

According to Fitts (1965) people's concepts of themselves have been demonstrated to be highly influential in much of their behaviour and also to be directly related to their general personality and state of mental health. Knowledge of a person's self-concept, which cuts across motives, needs, attitudes and values, is a means for better understanding that person's behaviour. People who view themselves as undesirable, worthless, or "bad" tend to act accordingly. Those who have a highly unrealistic concept of the self tend to approach life and other people in unrealistic ways. Thus, knowledge of how people perceive themselves is useful in attempting to help them or in making evaluations of them.

"The individual is our greatest resource in accomplishing his rehabilitation, and rehabilitation is a matter of helping the individual to utilize and actualize his own resources" (Fitts *et al* 1971, p. 4). According to Maslow (1954), self-actualization is the process of making actual or real the potential resources of the individual. Maslow (1954) feels that self-actualization is the drive to become what one is capable of being; that this is what motivates a person's behaviour. Thus, rehabilitation and self-actualization are related. Rehabilitation promotes self-actualization. Thus, the goal of a good exercise programme should be to reactivate and strengthen the drive towards self-actualization. The ease or difficulty in promoting self-actualization is a function of the potential resources of the individual.

2.2.2 Relationship between physical fitness and psychological well-being

A. General research

A critical review of the evidence supporting the positive relationship between physical fitness training and mental health variables has been evaluated by Folkins and Sime (1981). From an examination of 120 studies dealing with physical fitness and mental health Folkins and Sime (1981) concluded that fitness training seemed to help people cope with psychological stresses and tended to promote general well-being in the individual. Regarding the research on the self-concept specifically, their review indicates that research has generally confirmed the assumption that fitness training improves self-concept. Positive changes have been found for elementary age children (Martinek *et al* 1978), seventh-grade males (McGowan *et al* 1974), obese teenage males (Collingwood and Willett 1971), college students (Hilyer and Mitchell 1979), adult females (Hanson and Nedde 1974) and adult male rehabilitation clients (Collingwood 1972). Mauser and Reynolds (1977), however found that an activity programme had no effect on children aged four to twelve years. Bruya (1977) also found no change in self-concept or fitness in fourth grade pupils after four weeks of 30-minute movement sessions, twice a week. Folkins and Sime (1981) suggested that more research of an experimental or a quasi-experimental nature be done to study self-concept and physical activity.

A number of correlational studies designed to explore the relationship between physical fitness and psychological well-being have been undertaken. Tillman (1965) conducted a multi-phase study of which one purpose was to determine the association between two measures of physical fitness, pull-ups and the 600-yard run, and sundry personality traits in 386 teenage males. The results indicated that the more-fit boys were significantly more ascendant, surgent and group oriented, and significantly less tense than were the less-fit subjects. Later, Garvin (1972) studied the relationship between physical fitness and personality using 189 junior college males. Employing canonical correlation analysis, a strong association between indices of personality and physical fitness were found.

Folkins and Lynch (1972) investigated the possibility that improvements in physical fitness would be associated with positive changes in indices of psychological fitness. The results reflected a significant correlation between the major physical fitness variable, 1,75 mile (2,8km) run test, and the indices of psychological fitness (depression, self-confidence, adjustment and work efficiency) for that group of women who showed the most physical fitness change. No significant correlations were found for the males. Similarly, Sharp and

Reilly (1975) found several significant correlations between aerobic fitness and attributes of personality as measured by the MMPI for 65 male college students.

Ismail and Young (1976) conducted a study to determine personality differences among 58 middle-aged males categorized according to a variety of measures of physical fitness. They found that regardless of age, the more-fit subjects tended to be more intellectually inclined, emotionally stable, composed, self-confident, easy-going, relaxed, and less ambitious and unconventional than were the low-fit subjects. Tucker (1983) investigated the relationship between relative muscular strength and personality in college males. The results showed relative muscular strength to be a significant predictor of body cathexis, extraversion, neuroticism, and global self-concept. Generally, the author found that relatively strong males were significantly more satisfied with their body parts and processes, less emotionally labile and anxious, more outgoing, sociable and impulsive, and more confident and satisfied with themselves than were their muscularly weaker counterparts.

A more recent study was undertaken by Tucker (1987) to determine the relationship between multiple measures of mental health and physical fitness among 385 high school boys. Results indicated that mental health and physical fitness, considered multivariately and univariately, were related significantly. Generally, as fitness increased, subjects were more intelligent, emotionally stable, venturesome, practical and self-confident. The findings suggest that high-levels of physical fitness should be promoted, not only because of the physiological advantages associated with this condition, but because of the psychological benefits as well.

Three studies have looked specifically at physical fitness and self-concept. Baron (1970) assessed 67 middle-aged males on a battery of physical fitness and self-concept measures. The author concluded that as physical functioning increases, individuals tend to view themselves and others more positively. Using 152 male college students, and canonical correlation as the primary data analysis strategy, White (1974) revealed similar results. Likewise, research by McGlenn (1976) involving 43 adolescent males revealed significant associations between levels of physical fitness, body image and self-concept.

Not all research has shown significant positive associations to exist between measurements of physical fitness and psychological well-being. Hammer and Wilmore (1973) found little correlation between the variables and hence concluded that cardiovascular fitness seems to have little psychological predictive utility. Studies which have employed the self-concept as the criterion measure have found similar results (Johnson 1969, Neale *et al* 1969, Christian 1970, Sebold 1977, Leonardson and Gargiulo 1978).

Johnson (1969) found no significant relationship between physical fitness and self-concept. Working with 165 adolescent boys as subjects, Neale *et al* (1969) reported a significant relationship between general self-esteem and levels of physical fitness. Similarly, research by Christian (1970) involving 189 male college students revealed no significant association between physical fitness, as measured by a selected test battery, and self-concept, as measured by the Tennessee Self Concept Scale. Sebold (1977) investigated the relationship between self-concept and muscular strength in 10 and 11 year old children. The results indicated no significant relationship between self-concept and muscular strength. In addition, Leonardson and Gargiulo (1978) found that aerobic physical performance and self-concept were not correlated significantly in their study, which used 15 male and female college freshmen.

Studies that have examined the relationship between physical fitness and self-concept employed different physical fitness tests. Many of the studies employed a battery of three or more physical fitness tests (Johnson 1969, Neale *et al* 1969, Baron 1970, Christian 1970, Garvin 1972, White 1974, McGlenn 1976, Ismail and Young 1976, Leonardson and Gargiulo 1978, Tucker 1987). Some of the studies assessed only muscular strength (Sebold 1977, Tucker 1983) or cardiovascular indices (Tillman 1965, Folkins and Lynch 1972, Hammer and Wilmore 1973, Sharp and Reilly 1975).

It is generally accepted that physical fitness is a multi-dimensional concept comprising of muscular strength and endurance, flexibility, cardiorespiratory endurance and body composition. Many of the studies that found weak correlations between measures of physical fitness and global self-esteem employed test batteries that evaluate cardiorespiratory endurance, dexterity (motor skills) and muscular strength. These however, failed to access muscular endurance, flexibility and body fat composition (Johnson 1969, Neale *et al* 1969, Christian 1970, Hammer and Wilmore 1973, Sebold 1977, Leonardson and Gargiulo 1978). Balogun (1987) is the only reported study to have determined the relationship between all five measures of physical fitness (cardiorespiratory function, muscular strength and endurance, flexibility and body composition) and self-concept. The results of the study revealed that percentage body fat ($p < 0,05$) and flexibility ($p < 0,01$) are both significantly related to measures of self-concept. However, muscular strength and endurance and cardiorespiratory fitness were found not to relate significantly to measures of self-concept. Further studies are needed to corroborate and further investigate the psychological predictiveness of these five physical fitness components.

B. Self-concept and aerobic dance

Historically, ideas of feminine beauty have reflected the aesthetic standards of that era, and have varied from decade to decade (Warrick and Tinning 1989a). In the last 25 years in the Australian, European and North American cultures there have been tendencies towards increased slenderness as the "ideal" body shape for women (Garner *et al* 1980, Koval 1986). Slenderness signifies social success whereas obesity connotes a negative image. This increased emphasis on slenderness has been concurrent with the growth of exercise awareness and participation, and with the popularisation of new forms of physical activity such as aerobic dance (Epling *et al* 1983).

As a recreational activity, aerobic dance is group based and non-competitive. It is available to varying age-groups, and is equated with fitness, physique improvement and social interaction. Aerobic dance involves movements incorporating rhythm, grace, co-ordination and flexibility and ideally such movements are to be pursued without straining the body. A unique psycho-social milieu exists in aerobic dance classes. Camaraderie develops among participants who attend regularly. Among other things they discuss diets, attempts at losing weight, the benefits they achieve from exercising, how their clothes fit better and how sore their bodies were from the last class. Solidarity develops as conversations centre around shared situations, aspirations and problems. When the exercises become strenuous, the participants groan a lot and a sense of togetherness is fostered. Participants encourage each other thus furthering social cohesion (Kenen 1987, Warrick and Tinning 1989a).

According to Warrick and Tinning (1989 a and b) aerobic dance participation is not without its problems. Aerobic dance may liberate or oppress women with respect to their perception of their own bodies. The potential for exercise to enhance the self and body-image and cathexis has been well documented (Folkins and Sime 1981) and aerobic dance may be personalised, stimulating and an enjoyable avenue for self-expression and liberation from day-to-day pressures. However, the sub-culture of aerobic dance, with its emphasis on body weight and shape control, tends to reinforce the cult of slenderness which for many women is a source of anxiety, frustration and oppression (Warrick and Tinning 1989 a and b).

An important point from a South African perspective also needs consideration. A high incidence of obesity in black female adults is prevalent in South Africa (Abramson *et al*

1961, Walker 1964, Sloan 1966, Adadevoh 1974, Richards and De Casseres 1974, Ndaba and O'Keefe 1985, Walker 1986, O'Keefe *et al* 1983). Abramson *et al* (1961) studied the sex variation in the nutritional state of urban Zulu adults. They found considerable more adiposity among the women, manifested both in higher relative weights and in greater skinfold thickness measurements. It was concluded that this finding was probably largely related to their greater caloric intake and/or their lesser degree of activity, relative to the men. The authors also indicated that a high valuation was placed on female stoutness in that community. Furthermore, Adadevoh (1974) points out that the relative obesity seen in the African female is often culturally acceptable and may be perceived as a symbol of prosperity or beauty.

With these seemingly contradictory perspectives outlined it is important to establish the effect of low-impact aerobic dance on the self-concept of participants. However, a paucity of data exists in this area. In the studies by Eickhoff *et al* (1983) and Ford *et al* (1989) no changes were evidenced in any the psychological tests administered. However, studies by Shifron (1983), Plummer and Koh (1987) and Berryman-Miller (1988) reported positive changes in the psychological dimensions measured as a result of participation in aerobic dance. Some of the studies reviewed do not deal with the self-concept directly, but related aspects such as vocational self-concept and the subjective evaluation of general well-being.

Shifron (1983) examined the relationship between aerobic dance and vocational self-concept, a subscale of global self-concept, as measured by the Vocational Rating Scale. In addition, the study sought to determine whether such variables as age, education, employment, marital status and reasons for joining aerobic dance were related to vocational self-concept. The experimental groups consisted of 465 subjects who had participated in two aerobic dance classes every week for at least 12 weeks and the control group consisted of 117 subjects enroled for their first aerobic dance session. Significant differences in the subjects' mean vocational rating scores were found between the pre- and the post-treatment groups, and between the pre-treatment group and all the groups. Analysis of variance on subjects' mean vocational rating scale scores produced significant differences based on length of participation in the aerobic dance programme.

Eickhoff *et al* (1983) conducted one of the first studies to determine if aerobic dance of sufficient intensity, duration, and frequency could promote the improvement of self-concept, as well as produce physiological changes. The subjects consisted of 39 women, between the ages of 19 and 36 years, who enroled in a YWCA aerobic dance class. Of these, 19 subjects were randomly assigned to postpone participation in the class and serve as a control group. The counselling form of the Tennessee Self Concept Scale was used to measure two psychological dimensions of self-concept (total positive and physical self). When examining the overall analysis no evidence was found to suggest a change in either of the two psychological scores between the pre-test and the post-test. This overall lack of improvement or change following exercise training may, according to the authors, be attributable to the relatively desirable psychological characteristics that the subjects displayed prior to training. However, the results indicated that physical self scores improved significantly ($p < 0,05$) for those aerobic dancers who were initially classified as "low-fit". These findings suggest that among "psychological healthy" subjects, the initial physical fitness level was a principle determinant of whether such psychological profiles were improved by a particular exercise programme.

In the study by Watterson (1984) on the effects of aerobic dance on cardiovascular fitness, subjective questionnaires were answered by the participants at the end of the study. Sixty-four percent of the subjects stated they felt more energetic than they did at the beginning of the study, 86% said they would continue taking the aerobic dance class if it were offered, and 71% said they were planning to continue with some type of aerobic dance programme.

Plummer and Koh (1987) assessed the effects of aerobic dance on the self-concept of college women. The Tennessee Self Concept scale was administered to 116 college women enroled in the 10 week aerobic dance programme and to 177 in seven non-physical education classes. The aerobic dance group scored significantly higher ($p < 0{,}01$ and $p < 0{,}05$) on seven of the nine subscales (personal, family, behaviour, physical, social, identity, satisfaction), as well as in total positive or global self-concept score ($p < 0{,}01$). The results of this study suggest that improving self-concept was related to participation in the activity of aerobic dance. Although physical fitness testing was not part of this study, the number of times exercised each week was not related to the mean self-concept. Plummer and Koh (1987) also found no significant difference in the means between those who had taken aerobic dance previously and those who had not. They suggested that improvements in self-concept are temporary and that cessation of participation in aerobic dance activities may allow the self-concept to return to the individual's norm.

Berryman-Miller (1988) investigated the effects of dance/movement exercises set to music on the self-concept of elderly men and women between the ages of 55 and 85 years who were recruited from senior centres. The participants engaged in eight months of bi-weekly classes. Each session was carefully planned to include a general warm-up, a sequence of dance/movement done while sitting, standing and moving, and cooling down activities. Each session lasted 90 minutes. The mean scores on specific items in the Tennessee Self Concept Scale indicated that the experimental group possessed stronger self-concept in the areas of physical self and personal self. Berryman-Miller (1988) also indicated that the experimental group exhibited a sense of personal worth and feelings of adequacy, as individuals and in their relationships to others. The author inferred that in the adult aging process a sense of control, respect and valued identity should be maintained. These attitudes seem to be primary in regulating one's quality of life and perhaps one's longevity. The most significant conclusion to be drawn from this research is that dance/movement will influence the positive image of self-concept for the older adult. Thus, as the over-65 population continues to increase, the implementation of dance/movement programmes for improving self-esteem and rekindling "joie de vivre" should be encouraged (Berryman-Miller 1988).

Ward and McKeown (1988) investigated the body cathexis and morphological changes subsequent to a 10-week aerobic dance programme structured to cause minimal body composition alterations. The subjects were college-aged females enroled in an aerobic dance course which met twice a week for 10 weeks. The subjects responded to a 28-item Body Cathexis Scale. The anthropometrical variables of height, weight, six skinfolds, eight muscle circumferences and six skeletal diameters were measured. The results indicated that the aerobic dance programme had a minimal effect on body composition and body cathexis. However, the authors indicated that the aerobic dance programme studied was a physical education course taken to meet a university requirement. Therefore these findings may not have been representative of those occurring in commercial programmes where individuals participate for reasons other than a course credit. The authors concluded that additional psychological reasons for group exercise involvement related to self-esteem may have been present in the aerobic dance participants but were not measured in the study.

Ford *et al* (1989) studied the effects of aerobic dance, jogging, weight training, swimming and life-saving on health-related fitness and psychological well-being. After eight weeks of specific training, the results indicated that the joggers and aerobic dancers performed significantly more sit-ups than did the controls. Furthermore, the joggers, aerobic dancers, weight trainers and life-savers displayed significantly greater flexibility on the sit-and-reach test than did the controls. None of the activity groups differed from the controls regarding percentage body fat or the step-test scores. The two psychological inventories administered were the Rosenberg Self-esteem Scale and a Modified Body Cathexis Scale and the results indicated that none of the activity groups differed from the controls on these scales. The following reasons were given by Ford *et al* (1989) for the lack of significant training effects resulting from participation in the different activities. Firstly, the training period (eight weeks of thrice weekly sessions) may have been insufficient to engender widespread physical changes and alterations in self-perception. Secondly, substantial gains among the controls from the pre-test to the post-test regarding body-cathexis, sit-ups and the step test suggests that many of these subjects were physically active during the eight week treatment period. Assessment of extra-curricular physical activity confirmed this as the subjects of the control group averaged 44 minutes of exercise per day. Lastly, gains in physical fitness by subjects in the activity groups were probably specific to the movements performed in the different courses. Participation in extra-curricular physical activity, averaging 40 minutes of exercise per day, in addition to formal class participation, may also have affected the results of the experimental groups.

From the above discussion it is evident that a paucity of research presently exists on the psychological effects of aerobic dance. Only four reported studies (Eickhoff *et al* 1983, Plummer and Koh 1987, Berryman-Miller 1988, Ford *et al* 1989) have examined the effects of aerobic dance on psychological well-being. The results of these studies have not concurred with each other, hence more research is needed to further investigate the psychological implications of aerobic dance.

C. Summary

The growth of passive forms of entertainment has negatively affected our physical well-being. Automation and technology have freed many people from heavy physical work and manual labour (Simpson 1989). Exercise has become less necessary as a part of the normal work day of many adults, even though the need for regular exercise has not decreased (Corbin and Lindsey 1985). According to Harris (1985) many people get involved in exercise initially to get into shape, to lose a few kilograms, or to counter the ill effects of a sedentary life. However, in the process of reaching these initial goals, they may discover that other things happen. People discover that exercise is fun, that they experience a sense of total integration never reached before. They find that they are tuned into their bodies and discover things about themselves that are reinforcing in a most positive manner. Exercise and physical activity can provide opportunities to develop self-awareness through the integration of body, mind and feelings. Becoming conscious of what is happening within the body intensifies the experience and increases one's awareness. This awareness provides a type of feedback that produces a sense of mastery, control and competence that can be reached in no other way (Harris 1985).

A large body of research exists to substantiate the psychological health benefits of physical exercise (Collingwood and Willett 1971, Collingwood 1972, Hanson and Nedde 1974, McGowan *et al* 1974, Martinek *et al* 1978, Hilyer and Mitchell 1979, Wilfley and Kunce 1986). A number of correlational studies designed to explore the relationship between physical fitness and psychological well-being have been undertaken. Positive correlations between physical fitness and psychological well-being were established by Tillman (1965), Folkins and Lynch (1972), Garvin (1972), Sharp and Reilly (1975), Ismail and Young (1976), Tucker (1983) and Tucker (1987). Positive correlations between physical fitness and self-concept were established by Baron (1970), White (1974) and McGlenn (1976). However, there were studies that showed little correlation between physical fitness and self-concept (Johnson 1969, Neale *et al* 1969, Christian 1970, Sebold 1977, Leonardson and Gargiulo 1978). Some of these studies have indicated that beneficial results were most pronounced with subjects who were more distressed prior to exercise implementation. Others have argued that psychological improvements are associated with perceptions of change rather than actual change in fitness.

Many of these studies employed a battery of three or more different physical fitness tests. Some of the studies only assessed muscular strength, cardiorespiratory fitness or motor skills. Balogun (1987) is the only reported study to have determined the relationship of all five measures of physical fitness (cardiorespiratory function, muscular strength and endurance, flexibility and body composition) and self-concept. Further studies are therefore needed to corroborate and further investigate the psychological predictiveness of all five physical fitness components.

In addition, only four reported studies have looked at the effect of aerobic dance on self-concept (Eickhoff *et al* 1983, Plummer and Koh 1987, Berryman-Miller 1988, Ford *et al* 1989). Only two of these studies (Plummer and Koh 1987, Berryman-Miller 1988) have showed significant improvements in the self-concept after participation in an aerobic dance programme. More research is needed to establish the effect of aerobic dance on psychological well-being and to further investigate the unique psycho-social milieu that exists in the aerobic dance class.

CHAPTER 3

METHOD

Subjects

Testing Procedures

Health-related fitness tests

Psychological tests

Low-impact Aerobic Dance Programme

Statistical Analysis

Data for this study were collected at the Human Performance Research Laboratory, Department of Human Movement Studies, University of Fort Hare. Prior approval for conducting the study was obtained from the University of Fort Hare. Presented in this chapter are the procedures used to collect the data required to test the hypotheses stated in Chapter I. They include subject selection, testing procedures, a description of the health-related fitness and psychological tests administered, the aerobic dance programme conducted, and the statistical analyses performed.

3.1 SUBJECTS

Forty black female students studying at the University of Fort Hare volunteered for the study. Entry into the study was limited to female students who were not regularly engaged in physical activity. Regular physical activity was defined by aerobic exercise lasting for 20 minutes or more at least three times per week. The subjects had to be willing to participate three times per week for ten consecutive weeks in a low-impact aerobic dance class. The subjects also agreed not to exercise outside of class time and not to change their eating habits. A medical history questionnaire was administered to screen subjects for any medical condition that might contraindicate participation in strenuous exercise (Appendix A).

3.2 TESTING PROCEDURES

Prior to data collection, an informed consent statement (Appendix B) was completed by each subject. Subjects were pre-tested one week prior to beginning the training programme and post-tested within one week following the ten weeks of training. The subjects performed a battery of health-related fitness tests to measure cardiorespiratory and musculoskeletal functions and body composition (data collection sheet in Appendix C). The psychological tests administered to the subjects were the Tennessee Self Concept Scale (Fitts 1965) and the Body Cathexis Scale (Secord and Jourard 1953).

3.2.1 Health-related Fitness Tests

A. Cardiorespiratory function

Cardiorespiratory function was measured on a Monark bicycle ergometer using the Golding *et al* (1989) submaximal protocol to predict VO_{2max}. This protocol uses three or four consecutive three-minute work loads on the bicycle ergometer. The initial work load is 150 kgm.min^{-1}. The heart rate is taken during the last minute of the initial work load and is used to determine subsequent work loads. If the heart rate at the end of the first work load exceeds 100 beats per minute, the second work load is set at 300 kgm.min^{-1}, the third at 450 kgm.min^{-1} and the fourth at 600 kgm.min^{-1}. If the heart rate falls within the following limits, less than 80 beats, 80 to 89 beats or 90 to 100 beats per minute, subsequent workloads are set according to Figure 1.

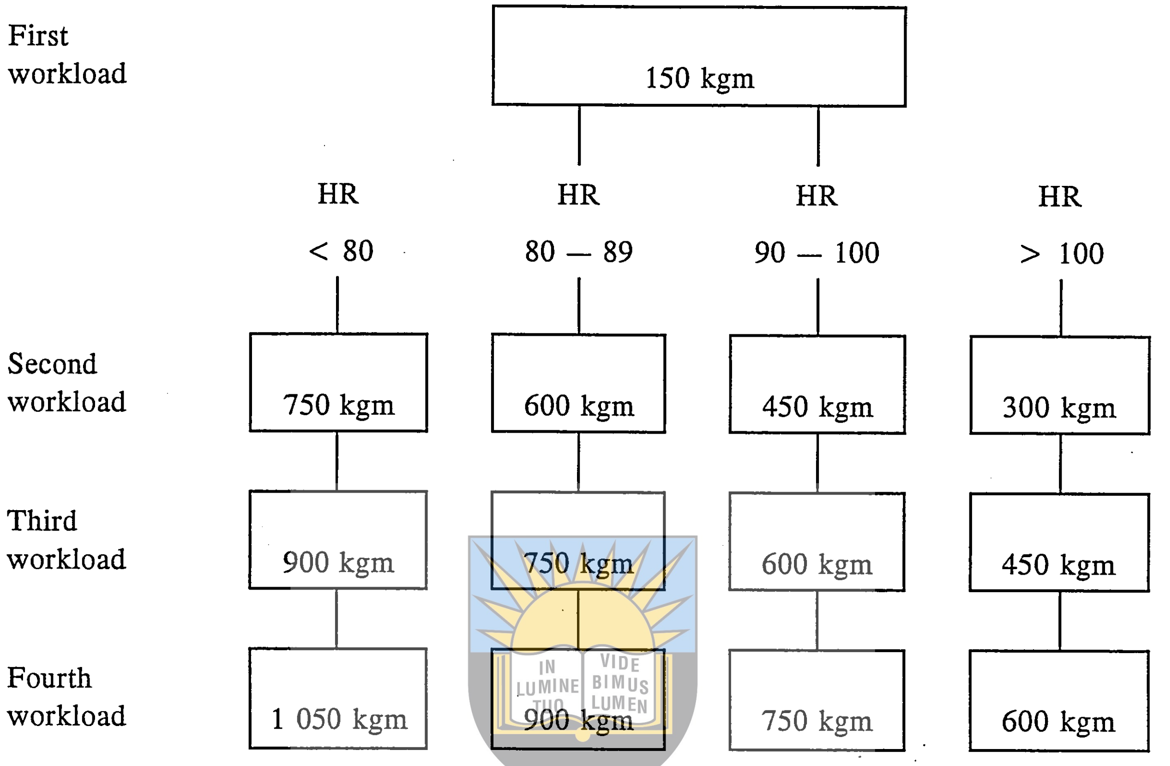


Figure 1: **Guide to setting work loads for the Golding *et al* (1989) bicycle ergometer test**

The heart rate is taken at the end of minutes two and three for each work load. If these heart rates differ by more than five beats per minute, the work load is extended an additional minute until the heart rate stabilizes.

Having completed the testing, the last two work loads and corresponding heart rates are plotted on a graph (Appendix D). These points are connected by a straight line, which is extended to intersect the predicted maximum heart rate line, determined by subtracting the subject's age from 220. At the point of intersection, the predicted VO_{2max} is extrapolated. The amount of work corresponding to a heart rate of 170 beats per minute was recorded as the individual's PWC_{170}. The heart rate was monitored using the Medilog M3 ECG Recorder and a CM-5 lead configuration.

B. Musculoskeletal function

Musculoskeletal function was measured using the following tests: strength tests (grip, leg and back); muscular endurance tests (the one-minute sit-up and the flexed arm hang); a power test (the standing long jump) and a flexibility test (the sit and reach).

A Takei grip dynamometer was used to measure the subject's grip strength (Heyward 1991). The handgrip size was adjusted to a position that was comfortable for the subject. The subject was instructed to stand erect, with arms at her side. The dynamometer was held to the side of the body, with the dial facing away from the body. The subject was instructed to squeeze the dynamometer as hard as possible without moving the arm. Three trials were administered for each hand, with a one minute rest between trials. The best score, in kilograms, for each hand was used for the data analysis.

A Takei back and leg dynamometer was used to measure the subject's leg strength (Heyward 1991). The subject placed her feet on the platform with the trunk erect and knees flexed to an angle of 130° to 140°. The hand bar was held using a pronated grip and was positioned across the thighs by adjusting the length of the chain. Without straightening the back, the subject was instructed to extend the knees maximally. The maximal force produced was recorded for the three trials. The best score, in kilograms, was used for the data analysis.

A Takei back and leg dynamometer was used to measure the subject's back strength (Heyward 1991). The subject sat in a long sitting position with the knees fully extended and the head and trunk erect. She placed her feet on the platform which was attached to the wall by means of a bracket. The hand bar was held using a pronated (right hand) and supinated (left hand) grip. The hand bar was positioned across the thighs and the subject was instructed to pull it back using the back muscles, and attempt to lie down with her back flat on the floor. The shoulders were rolled backward during the pull. The maximal force produced, in kilograms, was recorded for three trials, with the best score used for the data analysis.

Total strength scores were calculated by summing the right-grip strength, left-grip strength, leg-strength, and back-strength scores. Strength-mass ratio was determined by dividing the total strength score by the subject's body weight (Corbin *et al* 1978).

The one minute sit-up test (Andrews 1985) was used to measure muscular endurance of the abdominal muscles. The subject assumed a supine position on the mat, with fingers interlaced behind the head, knees bent and feet held flat on the mat by a partner. The partner knelt, straddling the subject's feet, and placed her hands on the calves of the subject's legs just below the back of the knees to prevent the subject from sliding and to maintain the starting position of the legs throughout the test. The subject sat up and touched her elbows to her knees and then returned to the starting position where only the shoulders had to touch the mat. The movement "sit-up and return" was counted by the partner as one execution. The total score was the number of complete executions performed in one minute.

The flexed arm hang test (AAHPER 1976) was used to measure the muscular endurance of the arms and shoulder girdles using a horizontal bar. Two spotters, one in front and one at the back, assisted in bringing the subject to the required position. The subject, using a pronated grip, raised the body off the floor so that the chin was above the bar with the elbows flexed and the chest close to the bar. The subject held this position for as long as possible. The score was the number of seconds, to the nearest second, that the subject maintained the proper position. The timing stopped when the subject's chin touched the bar, the subject's head tilted backward to keep the chin above the bar, or the subject's chin fell below the level of the bar.

The standing long jump test (Andrews 1985) was used to measure the power of the legs in jumping forward. With the feet slightly apart and the toes behind the take-off line, the subject bent the knees, swung the arms, and jumped as far forward as possible. If the subject lost her balance and fell back, the trial was repeated. The number of centimetres between the take-off line and the nearest heel on landing, in the best of three trials, was taken as the score.

Each subject performed the sit-and-reach flexibility test designed to evaluate lower back and hamstring flexibility as described by Wells and Dillon (1952). The subject was instructed to sit down at the testing apparatus with knees fully extended and the feet placed shoulder-width apart against the end board. She was then asked to reach forward in one smooth motion as far as possible without flexing the knees. Three trials were performed with the highest score, in centimetres, taken as the subject's flexibility score.

C. Body composition

Various anthropometric measurements were taken. The subject's height, in centimetres to the nearest millimetre, was taken using the stature gauge from the Martin-type Anthropometer set. Body weight was measured, in kilograms to the nearest hundredth gram, using the Detecto physician's beam balance scale. Eight skinfold measurements, in millimetres, were taken using the Lange Skinfold calliper. The sum of the triceps, suprailium and thigh skinfolds was used to estimate the percentage of body fat for the subjects (Pollack *et al* 1980). In addition, the biceps, triceps, subscapular, abdominal and suprailiac skinfold measurements were taken to enable comparisons to be made with the national physical fitness norms drawn up by Andrews (1990).

3.2.2 Psychological Tests

The Counseling Form of the Tennessee Self Concept Scale (Fitts 1965) (Appendix E) and the Body Cathexis Scale (Secord and Jourard 1953) (Appendix F) were administered to the subjects.

The Tennessee Self Concept Scale (TSCS) consists of 100 self-descriptive statements which the subject uses to portray her own picture of herself. The following scores are obtained from the scale: total positive score, self-criticism score, identity, self-satisfaction, behaviour, physical self, moral-ethical self, personal self, family self and social self. The scale is self administering and is suitable for subjects aged 12 and over (Fitts 1965). The Body-Cathexis Scale (Secord and Jourard 1953) consists of 46 descriptive items about one's body and its functions. These are evaluated on a five-point continuum from negative to positive. The scale measures one's level of satisfaction or dissatisfaction with various body parts and processes. It provides a method to assess the physical appearance component of physical self-concept (Ward and McKeown 1988). Two additional items were added to this list, namely "thighs" and "buttocks", as included by Ward and McKeown (1988).

3.3 LOW-IMPACT AEROBIC DANCE PROGRAMME

The aerobic dance training took place three times per week for ten consecutive weeks. Each session lasted 50 minutes and began with a 5 — 10 minute warm-up segment followed by 25 — 35 minutes of low-impact aerobic exercise. A 5 — 10 minute cool-down period followed the exercise phase. In view of the subjects' low fitness levels, as was evident from the results of the pre-tests, the exercise routine incorporated simple exercises performed at low intensity, during the first two weeks. Thereafter, the exercise intensity and the duration of the aerobic phase increased gradually with the 35 minute phase occurring in the eighth week and maintained till the end of the tenth week. The exercise session consisted of activities such as stretching, walking and progressively demanding dance routines. The dance routines combined various dance steps with other whole body movements including knee lifts, trunk twists, high powered steps, side to side movements, lunges and kicks. In addition, large upper body movements with a wide range of motion, as well as strengthening exercises, were included. The exercise session ended with stretching and relaxation. Each subject was taught how to take her carotid pulse and told what her target heart rate zone was. Maximum heart rate was computed as 220 beats per minute minus the age of the subject in years while the target heart rate was 70% — 85% of the calculated maximum heart rate. Heart rate was monitored at the beginning, middle and end of the aerobic phase of the routine.

3.4 STATISTICAL ANALYSIS

All the statistical analyses were computed using the SAS package. The means and standard deviations were calculated for the performance variables. A dependent one-tailed t-test was employed to determine the statistical significance between the pre- and post-tests.

The total positive and physical self scores of the Tennessee Self Concept Scale each served as the criterion (dependent) variable. The health-related fitness parameters (VO_{2max}, flexibility, body fat and muscular strength and endurance) were used as the predictor (independent) variables. Pearson's product-moment correlations were computed to determine the strength of the relationship between the criterion and fitness indices. Stepwise multiple regression techniques were used to determine the predictive strength of the fitness variables. The stepwise regression procedure selects the independent variables successively in the order of their relative strength in predicting the dependent variable.

For all tests, critical values at either the one or five percent level of significance were required for significance.

CHAPTER 4

RESULTS AND DISCUSSION

This study evaluated the effects of low-impact aerobic dance on the various measures of health-related fitness and the self-concept of selected female students at the University of Fort Hare. A self-concept and body cathexis test and a battery of health-related fitness tests were administered before and after the exercise programme to evaluate any changes in the self-concept and level of fitness of these subjects. Some of the raw data and the associated statistical analyses are presented and discussed below.

4.1 RESULTS

4.1.1 Subjects

Forty subjects were accepted into the programme, of which 37 (92,5%) completed the study. The mean attendance at the 30 sessions of low-impact aerobic dance classes was 29 (96,67%). Descriptive data for the subjects are presented in Table 3. The ages of the subjects ranged from 19 to 24 years with a mean age 20,7 ± 1,66 years. The mean height and weight for the group was 157,6 ± 5,98cm and 60,6 ± 7,35kg, respectively.

Table 3: Descriptive data on subjects

	Mean	S.D.
Age (yrs)	20,7	1,66
Height (cm)	157,6	5,98
Weight (kg)	60,6	7,35

4.1.2 Health-related Fitness Test Items

A. Cardiorespiratory function

Results of the Golding *et al* (1989) bicycle ergometer submaximal protocol to predict VO_{2max} and the PWC 170/kg test are shown in Table 4. Analysis of the T-tests showed that VO_{2max} and PWC 170/kg improved significantly ($p < 0,01$) after the ten week low-impact aerobic dance programme.

Table 4: **Cardiorespiratory function data**

	Pre-test		Post-test		%
	Mean	S.D.	Mean	S.D.	Change
VO_{2max} ($ml.kg^{-1}.min^{-1}$)	28,22	3,40	33,06	3,35	17,1*
PWC 170/kg (kpm/min)	8,35	1,10	9,86	1,12	18,1*

* Significant difference at the one percent level ($p < 0,01$)

B. Musculoskeletal function

Tests measuring muscular strength and endurance, power and flexibility were conducted before and after the ten week low-impact aerobic dance programme. The means, standard deviations and statistical parameters obtained from the pre-test and post-test results are shown in Table 5. Analysis of the T-tests showed that the low-impact aerobic dance programme resulted in a significant improvement ($p < 0,01$) in all aspects of musculoskeletal function.

Table 5: **Musculoskeletal function data**

	Pre-test		Post-test		%
	Mean	S.D.	Mean	S.D.	Change
Muscular Strength					
Right grip (kg)	32,19	4,64	33,53	3,99	4,2*
Left grip (kg)	29,72	4,93	31,49	4,66	6,0*
Back (kg)	78,08	15,60	91,95	16,17	17,8*
Leg (kg)	73,97	19,71	87,46	18,28	18,2*
Total (kg)	213,96	34,55	244,42	34,34	14,2*
Strength/mass ratio	3,56	0,67	4,09	0,70	14,9*
Muscular Endurance					
1-minute sit-ups (#)	19,70	8,79	32,80	8,46	66,6*
Flexed arm hang (sec)	2,90	5,46	8,20	9,35	185,3*
Power					
Standing long jump (cm)	140,40	13,65	152,10	14,66	8,3*
Flexibility					
Sit and reach (cm)	37,40	5,03	39,00	4,64	4,0*

* Significant difference at the one percent level ($p < 0,01$)

C. **Body composition**

The means, standard deviations, and statistical parameters obtained from the pre-test and post-test results are shown in Table 6. Percentage body fat was derived using the sum of the triceps, thigh and suprailiac skinfolds (Pollack *et al* 1980). Analysis of the T-tests showed significant changes in the biceps ($p < 0,05$) and triceps ($p < 0,01$) skinfolds. Significant changes also occurred in the sum of the triceps, thigh and suprailiac skinfolds (p

< 0.01) and percentage body fat ($p < 0,01$). However, there was no significant change in the mean body mass.

<u>Table 6</u>: **Body composition data**

	Pre-test		Post-test		%
	Mean	**S.D.**	**Mean**	**S.D.**	**Change**
Body mass (kg)	60,6	7,35	60,5	7,69	-0,3
Skinfolds (mm)					
Biceps	7,8	2,73	7,4	2,53	-3,8**
Triceps	20,5	3,49	19,7	3,44	-3,6*
Subscapular	15,0	4,62	14,7	4,67	-2,2
Abdomen	15,7	4,41	15,4	4,32	-2,0
Suprailiac	16,2	4,41	16,0	4,56	-1,3
Sum of triceps, thigh, suprailiac	65,4	9,55	64,0	9,51	-2,1*
Body fat (%)	25,5	3,04	25,0	3,05	-1,9*

* Significant difference at the one percent level ($p < 0,01$)

** Significant difference at the five percent level ($p < 0,05$)

4.1.3 Psychological Tests

The Tennessee Self Concept Test (Fitts 1965) and the Body Cathexis Test (Secord and Jourard 1953) were conducted before and after the ten week low-impact aerobic dance programme. The means, standard deviations and statistical parameters obtained from the pre-test and post-test results are shown in Tables 7 and 8. Analysis of the T-tests showed significant changes ($p < 0,01$) in seven of the nine subscales of the Tennessee Self Concept

Test: physical self, moral-ethical self, personal self, family self, social self, identity and behaviour, as well as the total positive (self-concept) score. Only the self criticism and self satisfaction scores did not differ significantly.

Table 7: **Tennessee Self Concept Scale data**

	Pre-test		Post-test		%
	Mean	S.D.	Mean	S.D.	Change
Total positive	290,7	15,53	305,0	13,96	4,9*
Physical self	56,0	4,32	60,6	4,69	8,1*
Moral-ethical self	58,0	4,02	60,2	3,95	3,8*
Personal self	53,0	4,94	55,9	3,61	5,4*
Family self	65,1	4,84	67,4	5,03	3,5*
Social self	58,6	4,48	60,7	3,77	3,6*
Self criticism	31,1	4,54	31,6	4,42	1,8
Identity	85,9	5,91	92,0	6,54	7,2*
Self satisfaction	110,2	9,30	112,4	8,85	2,0
Behaviour	94,6	6,38	100,6	7,49	6,3*

* Significant difference at the one percent level ($p < 0,01$)

In the body cathexis test significant changes ($p < 0,01$ and $p < 0,05$) were found for most of the items on the scale (Table 7). Only the following items on the scale did not change significantly: hair, distribution of hair, breathing, ears, chin, age, eyes and sex organs.

Table 8: **Body cathexis data**

	Pre-test		Post-test	
	Mean	**S.D.**	**Mean**	**S.D.**
Hair	3,9	0,98	4,1	0,97
Facial complexion	3,8	1,35	4,4	0,89*
Appetite	2,9	1,13	3,6	0,90*
Hands	3,8	1,27	4,2	0,93**
Distribution of hair	4,0	1,08	4,3	0,74
Nose	3,9	1,56	4,4	0,72*
Fingers	3,6	1,32	4,1	0,97*
Elimination	3,2	1,13	3,5	0,93**
Wrists	3,5	1,44	4,2	0,87*
Breathing	4,0	0,94	4,2	0,82
Waist	3,2	1,44	3,9	1,00*
Energy level	3,3	0,93	4,2	0,50*
Back	3,5	1,19	4,1	0,95*
Ears	4,0	1,00	4,2	0,82
Chin	4,1	0,91	4,2	0,78
Exercise	3,8	1,28	4,6	0,50*
Ankles	3,8	1,04	4,1	0,85**
Neck	3,8	0,97	4,2	0,75*
Shape of head	3,8	1,27	4,2	0,99**
Body build	3,1	1,21	4,1	0,89*
Profile	3,8	0,86	4,1	0,62**
Height	3,5	1,37	4,0	1,14*
Age	4,6	0,76	4,7	0,56
Width of shoulders	3,7	1,08	4,1	0,79*
Arms	3,2	1,23	4,0	0,91*
Chest	3,5	1,07	4,1	0,77*
Eyes	3,9	1,40	4,3	0,74
Digestion	3,2	1,20	3,8	1,03*
Hips	2,2	1,31	3,3	1,24*
Skin texture	3,1	1,41	3,9	1,04*
Lips	3,8	1,29	4,3	0,88*
Legs	3,4	1,46	4,2	1,09*
Teeth	3,7	1,30	4,1	1,17*
Forehead	3,8	1,02	4,2	0,78*
Feet	3,3	1,22	4,0	1,07*
Sleep	3,6	1,04	4,3	0,84*
Voice	3,8	1,06	4,1	0,79**
Health	4,2	0,74	4,4	0,60**
Sex activities	4,0	0,87	4,3	0,62*
Knees	3,5	1,15	4,1	0,82*
Posture	3,6	1,04	4,4	0,59*
Face	3,7	1,31	4,2	0,78*
Weight	1,8	0,99	3,3	1,15*
Sex organs	4,1	0,86	4,4	0,79
Back view of head	3,8	1,00	4,1	1,00*
Trunk	3,1	1,06	3,9	0,86*
Buttocks	2,8	1,24	3,1	1,36*
Thighs	2,6	1,17	2,9	1,25*
Total Sum (Body Cathexis Score)	170,2	21,93	195,2	18,23*

* Significant difference at the one percent level ($p < 0{,}01$)

** Significant difference at the five percent level ($p < 0{,}05$)

4.1.4 Relationship between Self-concept and Health-related Fitness

The correlational analyses between the measures of the self-concept and health-related fitness indices are presented in matrix form (Tables 9 and 10).

In the pre-test data (Table 9) no correlation was found between any of the fitness indices and the total positive score on the self-concept scale and body cathexis. Physical self correlated significantly with muscular endurance ($r = 0,43$; $p < 0,01$) and self-concept ($r = 0,67$; $p < 0,01$). Body fat was inversely related to muscular strength ($r = -0,58$; $p < 0,01$) and cardiorespiratory fitness ($r = -0,57$; $p < 0,01$). The correlation between cardiorespiratory fitness and muscular strength was statistically significant ($r = 0,38$; $p < 0,05$).

In the post-test data (Table 10) no correlations were found between any of the fitness indices and the total positive score on the self-concept scale. Physical self correlated significantly with muscular strength ($r = 0,41$; $p < 0,01$) and self-concept ($r = 0,48$; $p < 0,01$). Body cathexis was inversely related to self-concept ($r = -0,40$; $p < 0,01$). Body fat was inversely related to muscular strength ($r = -0,39$; $p < 0,05$), cardiorespiratory fitness ($r = -0,36$; $p < 0,05$) and flexibility ($r = -0,39$; $p < 0,05$). In addition, a significant correlation was found between muscular strength and cardiorespiratory fitness ($r = 0,36$; $p < 0,05$).

Table 9: **Correlation between measures of self-concept and health-related fitness (pre-test data)**

	FLX	STR	ME	CF	BF	SC	BI	BC
Flexibility (FLX) (sit-and reach)	1,00							
Muscular Strength (STR) (strength/mass ratio)	0,15	1,00						
Muscular Endurance (ME) (1-minute sit-ups)	0,20	0,17	1,00					
Cardiorespiratory Fitness (CF) (VO_{2max})	0,23	0,38**	0,10	1,00				
Body Composition (% body fat) (BF)	-0,18	-0,58*	-0,19	-0,57*	1,00			
Total Positive (self-concept) (SC)	0,27	0,09	0,27	-0,10	0,20	1,00		
Physical Self (body-image) (BI)	0,25	0,30	0,43*	-0,07	-0,03	0,67*	1,00	
Body Cathexis (BC)	0,28	-0,09	0,23	-0,17	0,11	-0,01	0,24	1,00

* Significant difference at the one percent level ($p < 0,01$)

** Significant difference at the five percent level ($p < 0,05$)

Table 10: **Correlation between measures of self-concept and health-related fitness indices (post-test data)**

	FLX	STR	ME	CF	BF	SC	BI	BC
Flexibility (FLX) (sit-and reach)	1,00							
Muscular Strength (STR) (strength/mass ratio)	0,27	1,00						
Muscular Endurance (ME) (1-minute sit-ups)	0,12	0,23	1,00					
Cardiorespiratory Fitness (CF) (VO_{2max})	0,07	0,36**	0,04	1,00				
Body Composition (% body fat) (BF)	-0,39**	-0,39**	-0,19	-0,36**	1,00			
Total Positive (self-concept) (SC)	0,01	0,19	0,12	0,06	0,08	1,00		
Physical Self (body-image) (BI)	0,16	0,41*	0,23	0,13	-0,32	0,48*	1,00	
Body Cathexis (BC)	0,06	-0,23	-0,08	-0,23	0,07	-0,40	0,09	1,00

* Significant difference at the one percent level ($p < 0,01$)

** Significant difference at the five percent level ($p < 0,05$)

Stepwise multiple regression techniques were used to determine the predictive strength of the health-related fitness variables. In the pre-test analyses of self-concept and body cathexis no fitness variable met the five percent level of significance. In the analyses of physical self (body image), muscular endurance was the only viable predictor of body image ($p < 0,01$), (Table 11).

In the post-test data analyses of self-concept and body cathexis no fitness variable met the five percent level of significance. In the analyses of physical self (body image), muscular strength was the only viable predictor of body image ($p < 0,05$), (Table 12).

Table 11: **Summary of the stepwise regression for physical self (pre-test data)**

Variable	Parameter Estimate	Standard Error	Sum of Squares	F	P
Intercep	51,90	1,61	16236,84	1032,95	0,0001
Muscular Endurance	0,21	0,08	122,81	7,81	0,0084

Table 12: **Summary of the stepwise regression for physical self (post-test data)**

Variable	Parameter Estimate	Standard Error	Sum of Squares	F	P
Intercep	49,46	4,30	2505,93	132,44	0,0001
Muscular Strength	2,73	1,04	130,69	6,91	0,0127

4.2 DISCUSSION

4.2.1 Subjects

The subjects were full-time female students studying at the University of Fort Hare who volunteered to participate in the low-impact aerobic dance programme. Forty subjects were selected after satisfying the requirements on the medical health questionnaire. The subjects' course levels ranged from first year of study through to honours level. The subjects came from all parts of Southern Africa, but were all resident at the University of Fort Hare for the duration of their studies.

The subjects' mean height of 157,6 ± 5,98cm ranked at the 10th percentile (Andrews 1990). This indicates that the subjects were comparatively short in relation to the subjects in the study by Andrews (1990). However, Andrews (1990) does indicate that only 9% of the sample used to compile the norms were black, which is not representative of the South African population. The subjects in the present study were also much shorter than the mean height of the subjects in the reported aerobic dance studies in Table 1 (165,0cm). The height of the subjects did however, compare favourably with the findings of Manley *et al* (1990) in their comparative study of the anthropometry and motor fitness of young black and white South African adults (Fig. 2). The mean height for the black female subjects in their study was 159,6 cm.

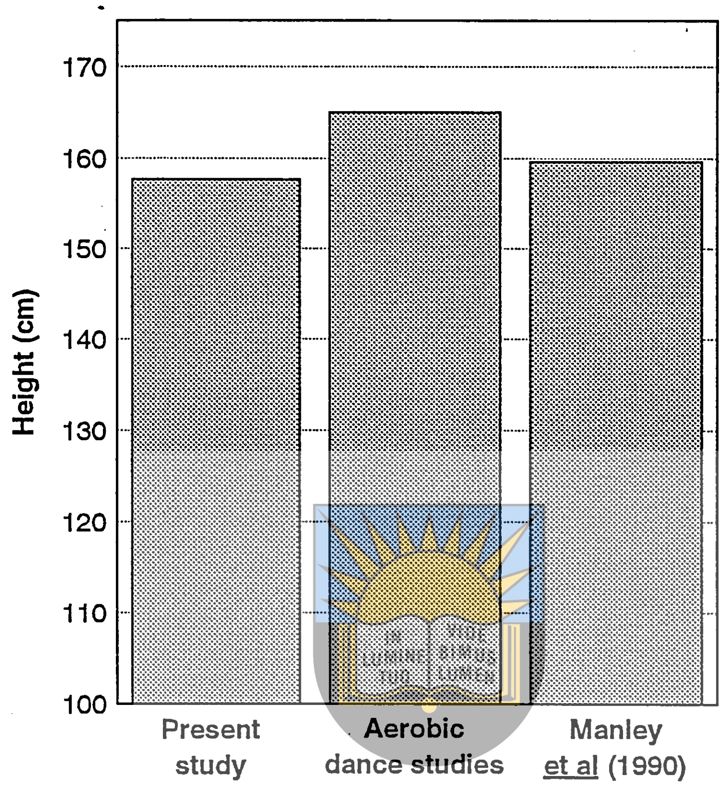


Figure 2: **Height: comparison with other studies**

The body mass of the subjects at the beginning of the low-impact aerobic dance programme was 60,6 ± 7,35kg which falls into the 47th percentile (Andrews 1990). This score compares favourably with the mean body mass score (61,7kg) of subjects in the aerobic dance studies in Table 1 (Fig. 3).

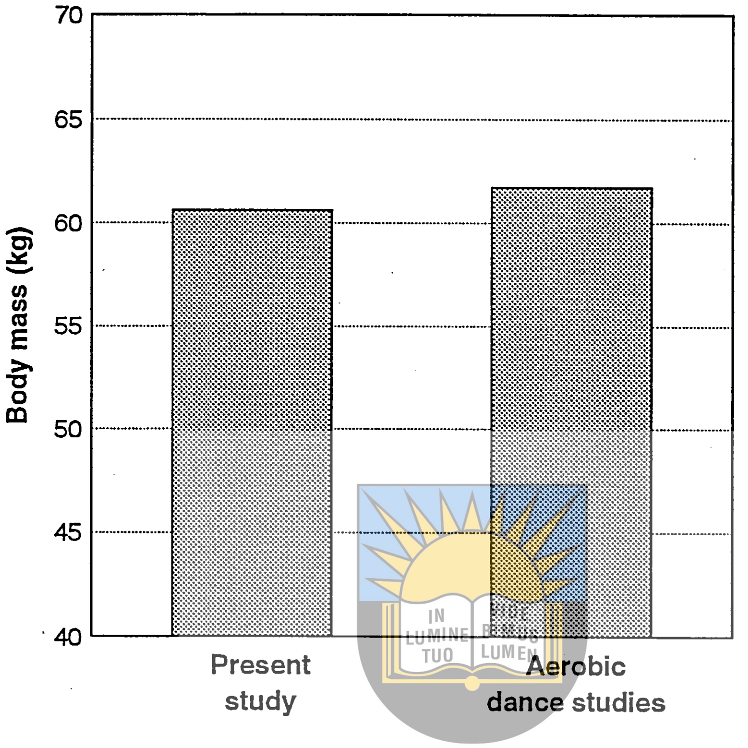


Figure 3: **Initial body mass: comparison with aerobic dance studies**

Three of the 40 subjects dropped out after three weeks, and their data were excluded from the study. This low dropout rate (7,5%) is in keeping with the nine aerobic dance studies which indicated their dropout rate (Rockefeller and Burke 1979, Cearly *et al* 1984, Watterson 1984, Dowdy *et al* 1985, Williams and Morton 1986, Gillett and Eisenman 1987, Williford *et al* 1988a, McCord *et al* 1989, Hopkins *et al* 1990). The dropout rate in these studies ranged from 0% to 23%, with a mean of 11% (Fig. 4). These scores may not be meaningful due to the small numbers participating in the studies (mean 15), and the short duration of the programmes (mean 10 weeks). The small sample sizes would have an adverse effect on the percentage dropout. For example, if three of the 15 participants dropped out of a study, the dropout percentage rate would be 20%. However, the percentage dropout in the present study is 7,5% (three out of 40). Results of studies on exercise adherence indicate that, on average, 50% of all those who enrol in an exercise programme drop out between six weeks and 26 weeks (six months) after the commencement of the programme (Dishman 1980, Dishman 1982).

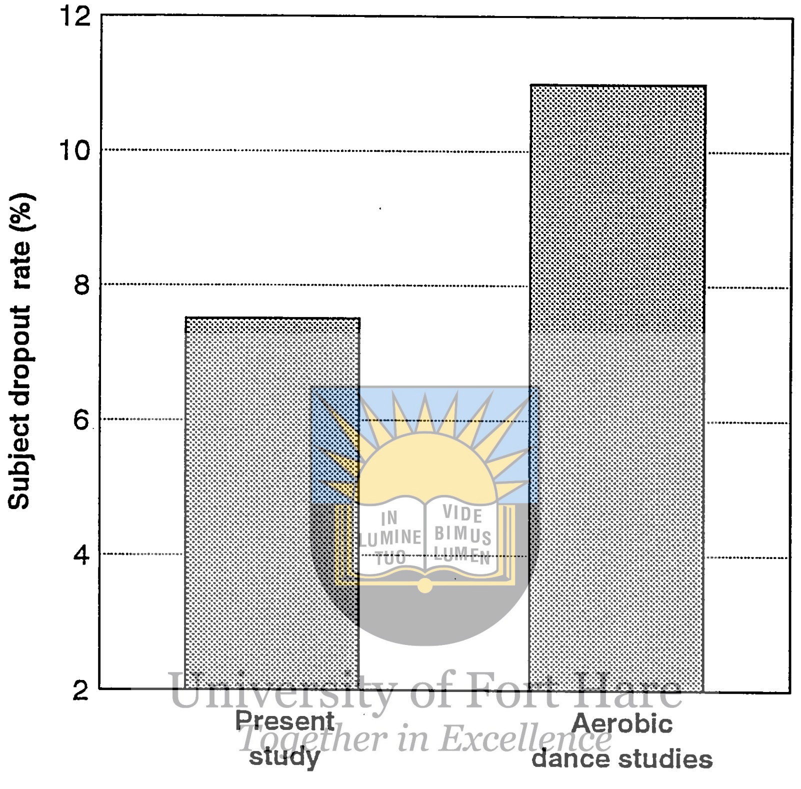


Figure 4: **Subject dropout rate: comparison with aerobic dance studies**

Adherence to the exercise programme was very high, with a mean attendance rate of 97%. Twenty-one (57%) of the 37 subjects who completed the exercise programme had 100% attendance. Only one subject's attendance fell below 90%, her attendance being 80%. These attendance figures surpass those of other studies where the average was 80% (Dishman *et al* 1980, Moses *et al* 1989). It has been argued by Martin *et al* (1984) that 80 — 85% is the maximum adherence rate to be expected for structured exercise programmes, even in populations with good facilities and favourable attitudes to exercise.

An explanation for the high rate of adherence in this study could be due to the two additional days that the low-impact aerobic dance class was offered. The subjects were only allowed to exercise three times a week. However, the two additional days offered the subjects the opportunity to make up for sessions missed on the prescribed days. This was offered at the request of the students, the reasons being that tests, examinations, additional lectures, tutorials or other academic activities occasionally coincided with the times of the aerobic dance classes and thus they requested the opportunity to make up for any of the sessions missed. This showed commitment on the part of the students to the exercise programme.

Ryan (1989) highlighted three areas affecting participant dropout. These were classified as intrinsic, extrinsic and health-related factors. The intrinsic reasons included having a negative attitude towards physical activity, lack of self motivation, a poor self image, especially in the obese, lack of immediate gratification, particularly in weight loss, and lack of enjoyment. In the present study, all the subjects were volunteers, none of whom could be classified as being obese or having a weight problem. Several studies quoted in Dishman (1988) rate the exercise leader as the single most important variable affecting exercise compliance. Ryan (1989) highlighted the following qualities of exercise leaders as important: personal qualities (sincere interest in the students, enthusiasm, being a good role model); interpersonal skills (communication skills, facilitating socialization and fun); and professional skills (knowledge in the field, providing consistency and variety). In the present study the researcher tried to implement the hints and guidelines related to the exercise leader as suggested by Ryan (1989).

The extrinsic factors pertained to the convenience of the class in terms of location and time. In the present study all the participants were resident on the campus where the programme was conducted and additional sessions were offered to make up for times when the allotted times were not suitable.

Health-related reasons included injuries sustained either in or outside of class, chronic or acute illness, a low level of physical fitness and pregnancy. In the present study there were no reported cases of injuries sustained. Occasionally a few subjects had acute illnesses (coughs, colds, menstrual pains) during which they excused themselves for a session, but were always eager to make up for the lost session later in the week when they were well.

4.2.2 Health-related Fitness Test Items

A. Cardiorespiratory function

The mean VO_{2max} for the subjects in this investigation was 28,23 ± 3,40ml.kg^{-1}.min^{-1} which falls into the "fair" category according to the data from the American Heart Association (Heyward 1991). Following the ten week low-impact aerobic dance programme, a mean VO_{2max} of 33,06 ± 3,35ml.kg^{-1}.min^{-1} was determined, which falls into the "average" category (Heyward 1991). This significant increase ($p < 0,01$) of 4,13 ml.kg^{-1}.min^{-1} represents a 17,1% improvement following training.

The mean percentage increase in VO_{2max} of the traditional high-impact aerobic dance studies was 12% as opposed to the mean increase of 11% reported for the low-impact studies, excluding the Gillett and Eisenman (1987) study as discussed in the summary in Chapter 2. By comparison, the 17% improvement in the present study is substantially higher than the other studies (Fig. 5). This may be due to the relatively low initial VO_{2max} scores of the subjects (28,23 ml.kg^{-1}.min^{-1}) in comparison with the mean initial VO_{2max} of the traditional high-impact aerobic dance studies (35,73 ml.kg^{-1}.min^{-1}) and low-impact aerobic dance studies (30,39 ml.kg^{-1}.min^{-1}). It has been suggested by Ekblom *et al* (1968) that the relative improvement in VO_{2max} with training is inversely related to an individual's initial VO_{2max}. McArdle *et al* (1981) and Pollock *et al* (1983) have also argued that where there is an initially low working capability there is greater potential for improvement, a situation which was clearly evident in the present study.

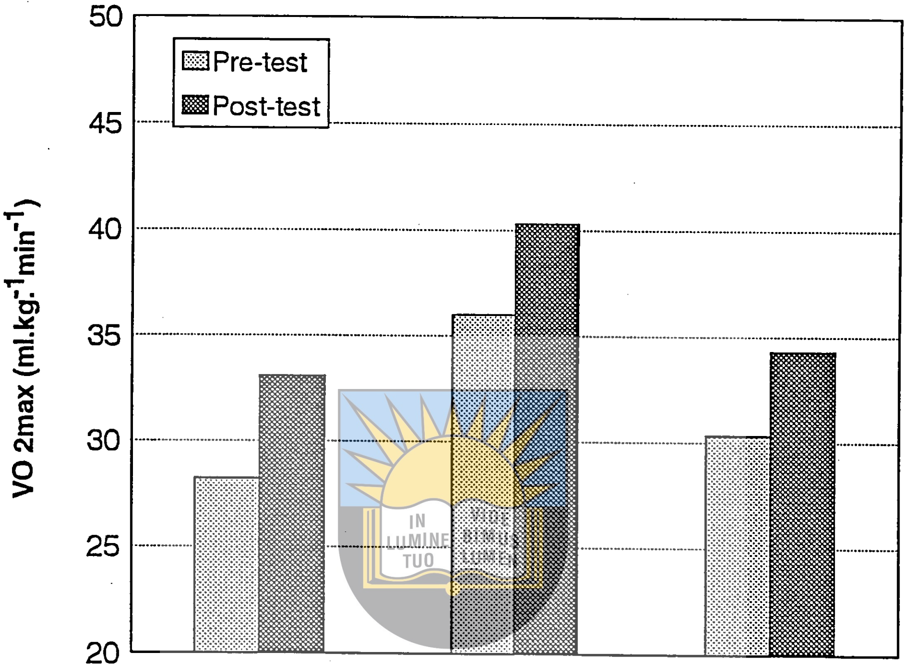


Figure 5: **Pre- and post- cardiorespiratory fitness test (VO_{2max}): comparison with aerobic dance studies**

McCord *et al* (1989) conducted the only reported training study of low-impact aerobic dance on college-aged subjects. The results in this study revealed a small, but significant, increase ($p < 0,05$) in VO_{2max} (38,3 $ml.kg^{-1}.min^{-1}$ to 41,3 $ml.kg^{-1}.min^{-1}$). It should be noted, however, that the pre-training mean VO_{2max} in the study by McCord *et al* (1989) was considerably higher than the present study (28,23 $ml.kg^{-1}.min^{-1}$) or the mean score for untrained college females (36,39 $ml.kg^{-1}.min^{-1}$) in the traditional high-impact aerobic dance studies (Rockefeller and Burke 1979, Vaccaro and Clinton 1981, Milburn and Butts 1983, Cearly *et al* 1984, Johnson *et al* 1984, Blessing *et al* 1987a, Blessing *et al* 1987b, Williford *et al* 1988a, Ford *et al* 1989), (Fig. 6).

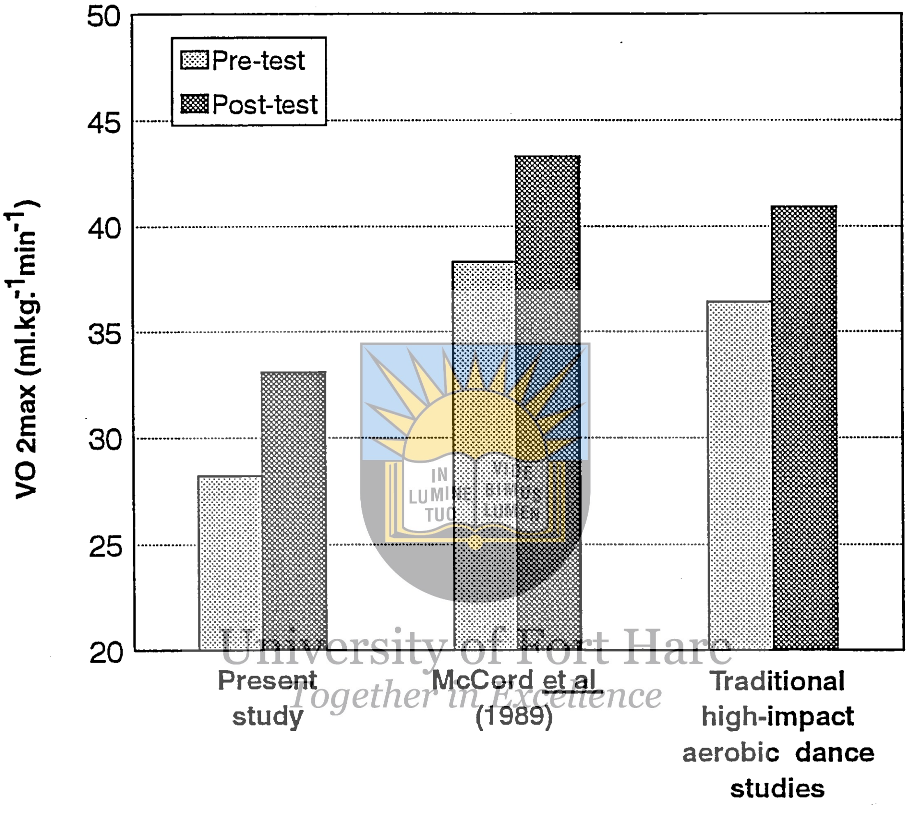
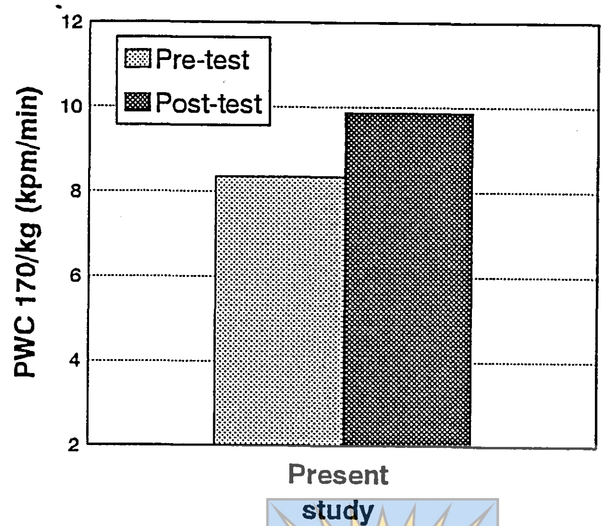


Figure 6: Pre- and post-test comparison of VO_{2max} with studies on college students

The relative PWC 170 score for the pre-test was 8,35 ± 1,10kpm/min, which ranks at the 13th percentile (Andrews 1990). This reflects the very poor cardiorespiratory fitness of the subjects. The post-test score increased significantly ($p < 0{,}01$) to 9,86 ± 1,12kpm/min and ranks at the 34th percentile (Andrews 1990). This improvement of 18,1% (Fig. 7) is in keeping with the view of McArdle *et al* (1981) and Pollock *et al* (1983) that where there is an initially low working capability there is greater potential for improvement.



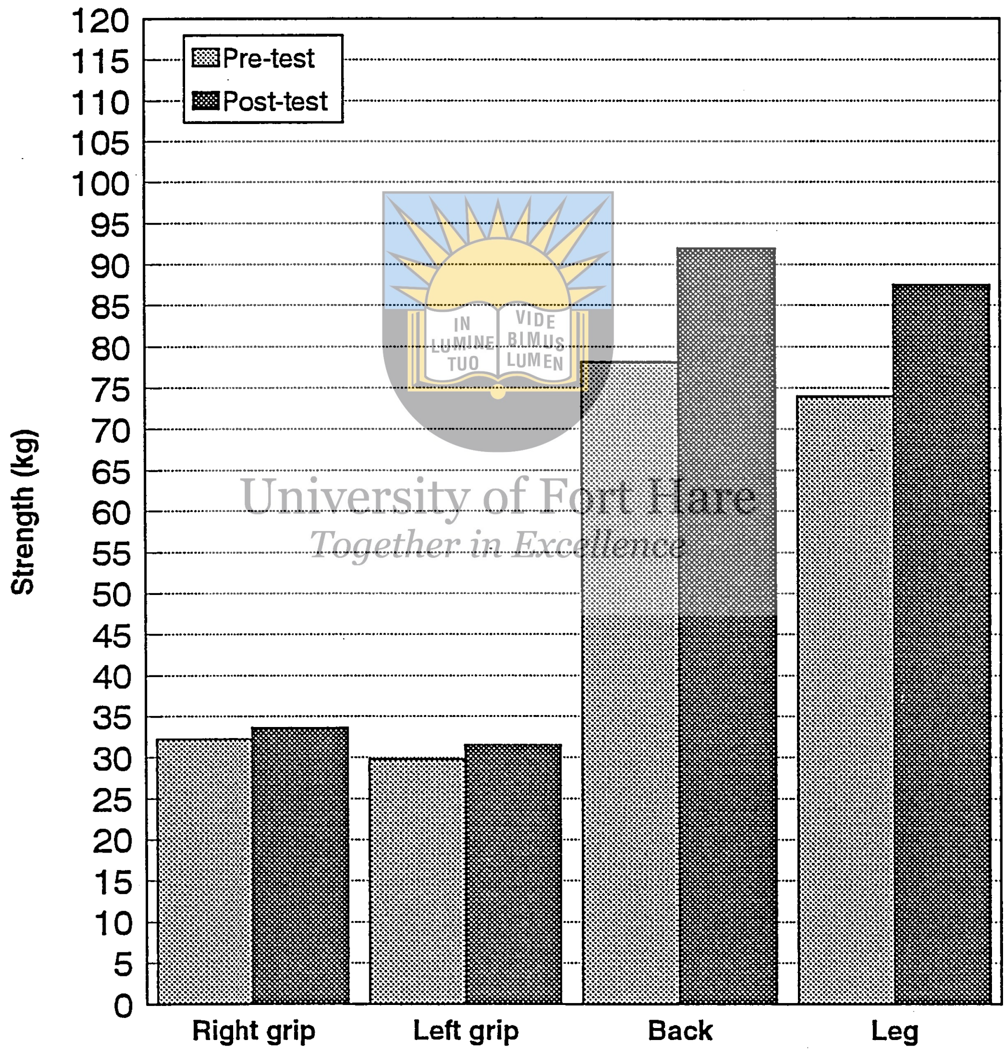
<u>Figure 7</u>: **Pre- and post- cardiorespiratory fitness test (PWC/170/kg)**

The improvement in cardiorespiratory fitness is an indication that low-impact aerobic dance produces similar cardiorespiratory benefits to traditional high-impact aerobic dance. During the aerobic phase of the low-impact aerobic dance programme the intensity of the workout was increased by varying the degree of difficulty of the steps, the cadence and the amount of work done by the arms and legs. Midway through the aerobic phase the subjects took their pulses and were encouraged to maintain a training heart rate of 70 — 85% of their age predicted maximum heart rate. Vigorous arm movements above the level of the heart were instituted to raise the heart rate into the target range. Thus the subjects were able to benefit aerobically from participation in low-impact aerobic dance, without the risk of injury associated with traditional high-impact aerobic dance.

B. Musculoskeletal function

i. Strength

Significant improvements ($p < 0{,}01$) were obtained in all the strength tests, namely, right grip, left grip, back, leg, total strength and the strength/mass ratio (Fig. 8). The mean scores for both the pre- and post-tests fell within the average category of the norms compiled by Corbin *et al* (1978). These findings are similar to the comparisons made using the norms by Andrews (1990). The pre- and post-test right grip strength scores of 32,19kg and 33,53kg ranked at the 45th and 55th percentiles, respectively (Andrews 1990). The pre- and post-test left grip strength scores of 29,72kg and 31,49kg ranked at the 50th and 60th percentiles, respectively (Andrews 1990).



<u>Figure 8</u>: Pre- and post- strength tests

An explanation for the significant improvement in strength is the strength training exercises for the upper and lower body which formed part of the conditioning phase of the routine. The exercises utilized the subjects' body mass to provide resistance to static and dynamic muscle contractions. In addition, eccentric and concentric isotonic exercises were included. These exercises, in which no weights were used, required the subjects to contract the muscles slowly and deliberately while resisting the movement.

ii. Muscular endurance

The scores for the one-minute sit-up test ranged from five to 38 with a mean of 19,7 ± 8,79 on the pre-test. This score reflects very poor endurance of the abdominal muscles, ranking at the fifth percentile (Andrews 1990). However, the post-test results, ranging from 15 to 47, revealed a significant improvement ($p < 0{,}01$), with a mean of 32,7 ± 8,46, and a percentile ranking of 40. The large increase of 66,6% may be due to the very low initial scores for the one-minute sit-up test, indicating a greater potential for change. These scores were a lot lower than those of Ford *et al* (1989) who reported a significant improvement of 16% in the one-minute sit-up test ($p < 0{,}05$) of 39,2 to 45,8 (Fig. 9).

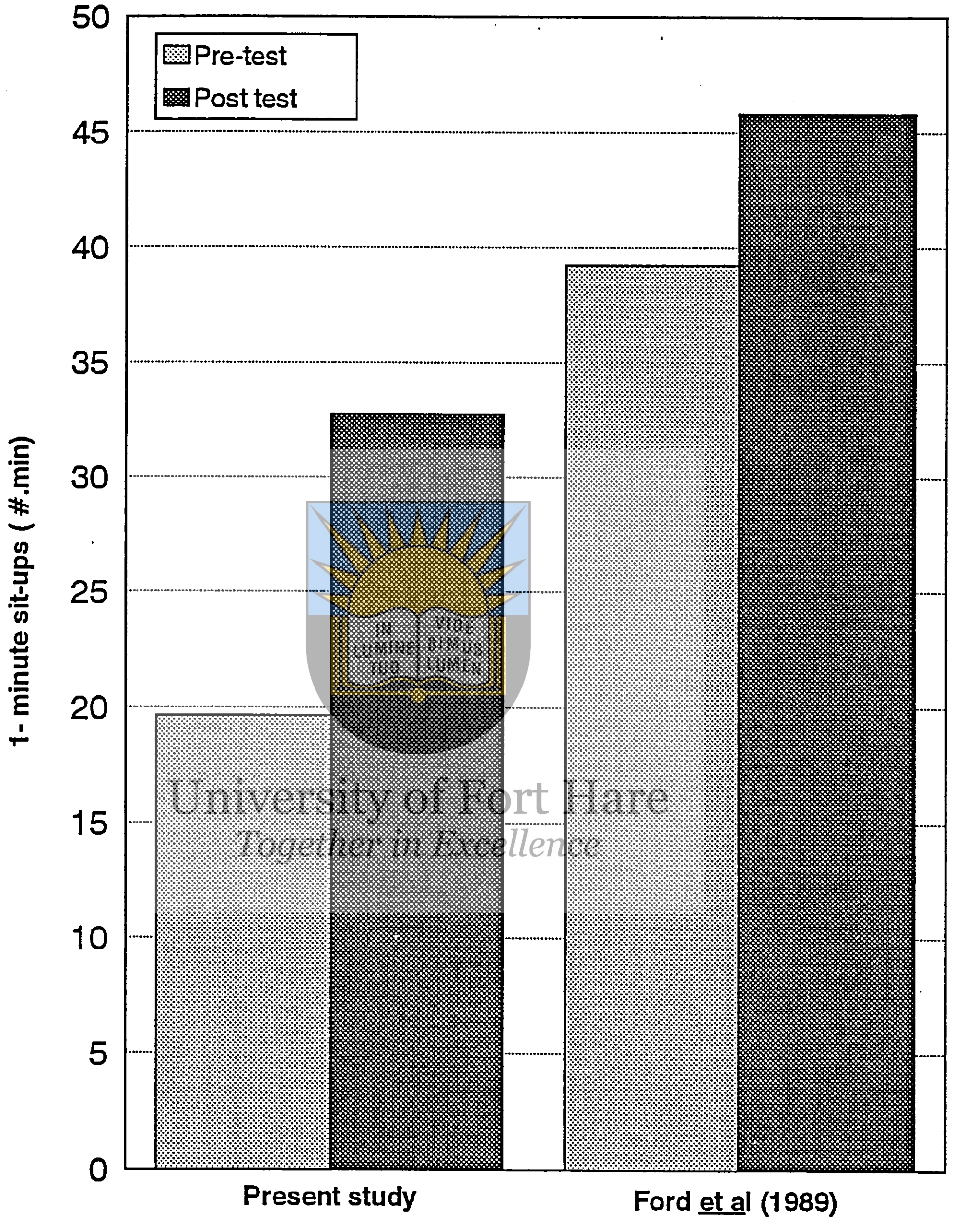


Figure 9: **Pre- and post- muscular endurance test (1-minute sit-ups): comparison with a traditional high-impact aerobic dance study**

In the present study the conditioning phase of the routine included a variety of abdominal exercises which would account for this significant improvement. These exercises were progressive in nature, increasing in frequency and difficulty in relation to the improvement in the subjects' fitness.

The results of the flexed arm hang test ranged from 0s to 30s on the pre-test with a mean of 2,9 ± 5,46s. This reflected very poor muscular endurance of the arms and shoulder girdle as most of the subjects were not able to support their body masses in the flexed arm hang position. The post-test mean 8,2 ± 9,35s showed a significant improvement ($p < 0{,}01$) of 185,3% (Fig. 10). This great increase again reveals a greater potential for change when the initial scores are very low. One of the important characteristics of low-impact aerobic dance is the variety of upper-body movements with a wide range of motion employed in routines. This, coupled with modified push-ups and related upper body exercises which were included in the conditioning phase of the routine, would account for the large improvement.

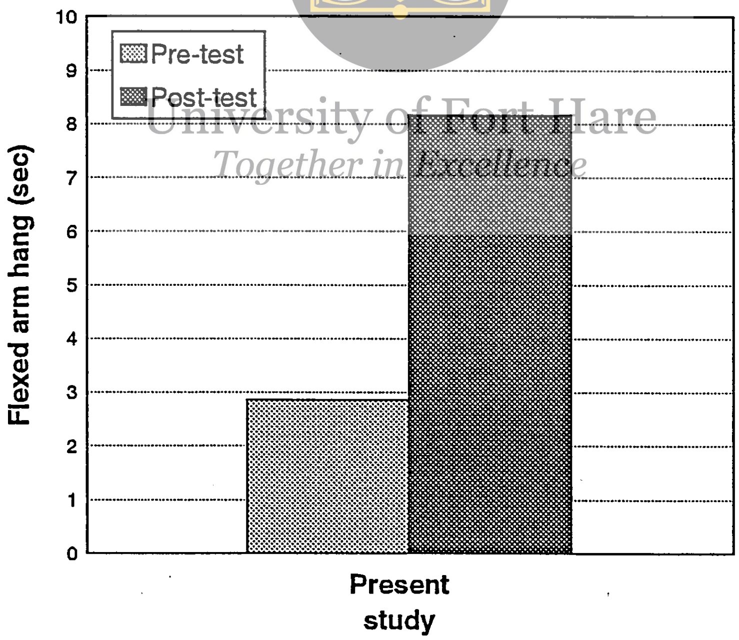
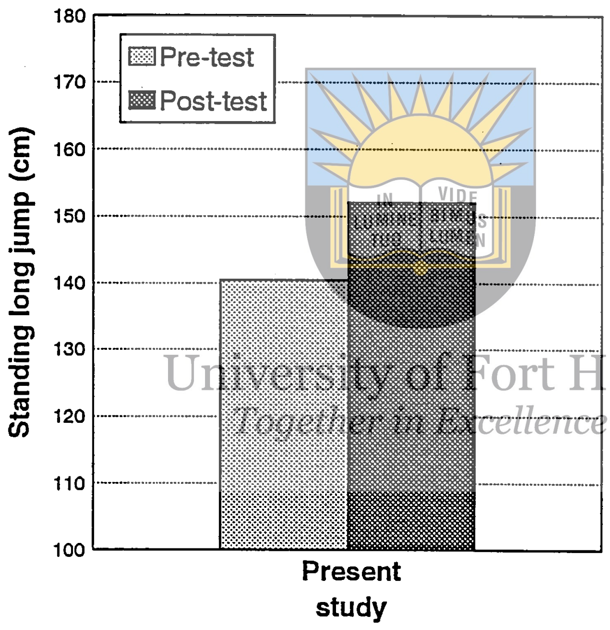


Figure 10: **Pre- and post- muscular endurance test (flexed arm hang)**

iii. Power

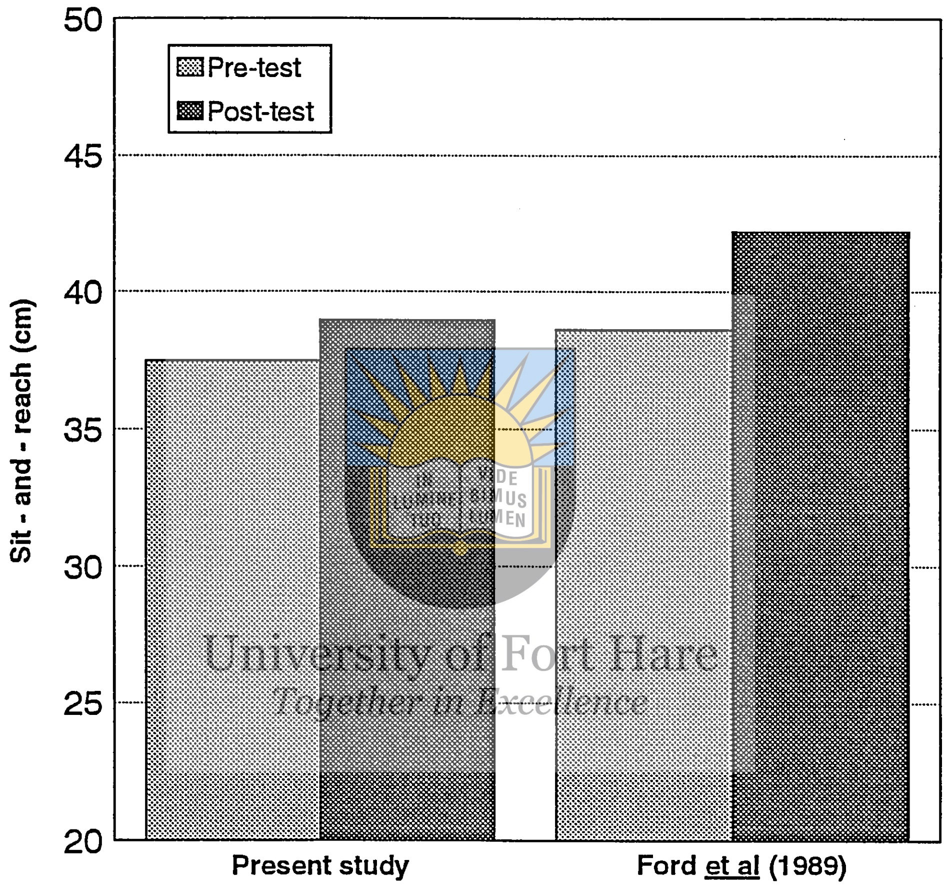
The mean scores for the standing long jump was 140,4 ± 13,65cm on the pre-test and 152,1 ± 14,66cm on the post test (Fig.11), ranking at the 14th and 43th percentile, respectively (Andrews 1990). This significant improvement ($p < 0{,}01$) again reflects a greater potential for improvement when the initial scores are very low. Even though low-impact aerobic dance does not employ the ballistic, running movements associated with high-impact aerobic dance, the high powered steps, side-to-side movements and lunges would account for the improvement in leg power. In addition, the strength training exercises of the lower body which used the subjects' body mass to provide resistance to static and dynamic contractions would contribute to the improvement in leg power.



<u>Figure 11</u>: **Pre- and post- power test (standing long jump)**

iv. Flexibility

The results of the sit-and-reach test indicated a mean score of 37,5 ± 5,03cm on the pre-test and 39,0 ± 4,64cm on the post-test, an improvement of 4,0%. These results compared favourably with Ford *et al* (1989) who reported a significant increase ($p < 0,05$) in the sit-and-reach test from 38,6cm to 42,2cm (9,3%) after eight weeks of aerobic dance, three times a week (Fig. 12). After adjusting the results of the present study to compare with the norms of Andrews (1990), scores of 52,5cm and 54,0cm were obtained on the pre- and post- tests, respectively. This reflects good flexibility of the lower back and hamstrings, ranking at the 75th and 80th percentile for the pre- and post- tests, respectively.



<u>Figure 12</u>: Pre- and post- flexibility test (sit-and-reach): comparison with a traditional high-impact aerobic dance study

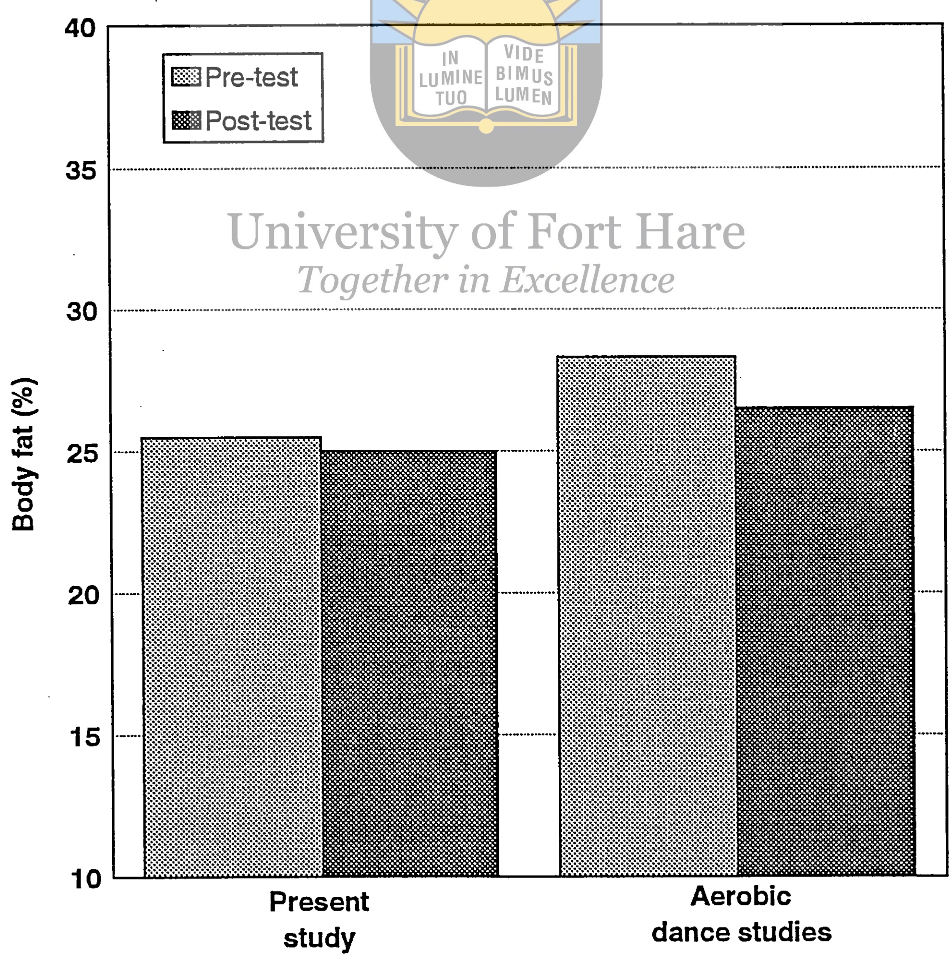
The low-impact aerobic dance programme included stretching exercises during both the warm-up and cooling down phase of the routine which would account for the significant improvement recorded at the end of the study. The forms of stretching techniques used were slow, static stretching and proprioceptive neuromuscular facilitation (PNF) stretching. At least one exercise for each major muscle group of the body was performed during each session. In addition, the length of time that the stretched position was held and the number of repetitions performed were progressively increased throughout the ten week programme.

C. Body Composition

The lack of significant change in body mass at the end of the training period is consistent with previous findings on aerobic dance (Rockefeller and Burke 1979, Vaccaro and Clinton 1981). Only two of the studies reviewed, Johnson *et al* (1984) and Williams and Morton (1986) indicated a significant change in body mass after training. Johnson *et al* (1984) indicated a significant decrease ($p < 0,05$) in body mass and percentage body fat after training. However, the initial body fat values in the study by Johnson *et al* (1984) were much higher than those reported in the majority of aerobic dance investigations. Several of these subjects were described by the authors as "obese", with body fat percentages of some participants exceeding 40%. Obese individuals tend to lose a significantly greater amount of body mass and body fat than non-obese individuals (Moody *et al* 1972). This may be one explanation for the favourable changes in body mass found in this study but not demonstrated in others. Subjects in the present study with a mean body mass of 60,6kg and 25% body fat can be considered average and hence the non-significant change in body mass at the end of the low-impact aerobic dance programme is not unexpected.

Williams and Morton (1986), however reported a mean increase ($p < 0,01$) in body mass of 1,3kg. They offered the explanation that the increase in total body mass was due to a concomitant increase in lean body mass which exceeded the decrease in percentage body fat. One explanation of the relatively large increase in lean body mass is that a strength training stimulus was included in the programme in the form of a number of progressive resistance exercises. These exercises utilized the body mass of the subject and that of a partner to provide resistance to static and dynamic muscle contractions. This type of exercise has been found to lead to large gains in lean body mass as it tends to act as a stimulus for muscle hypertrophy (Williams and Morton 1986).

A significant decrease (p < 0,01) in percentage body fat from 25,47% to 25,00% was found (Fig. 13). This is in agreement with Johnson *et al* (1984), Williams and Morton (1986), Blessing *et al* (1987a), Moore *et al* (1988), McCord *et al* (1989) and Hopkins *et al* (1990). This small, but significant, decrease is important in that no dietary controls were implemented. The subjects agreed not to exercise outside of class time and not to change their eating habits. The subjects were periodically questioned as to whether they were doing so and responded that they were abiding by the conditions of the study. Thus the subjects underwent significant body composition changes without a change in body mass, despite their average initial values.



<u>Figure 13</u>: **Pre- and post- percentage body fat: comparison with aerobic dance studies**

The subjects' pre- and post- skinfold scores are illustrated in Fig. 14. These measurements compared very favourably with the norms compiled by Andrews (1990). On the pre-test the highest percentile ranking was the suprailiac, with a percentile ranking of 51,0 followed by the triceps (P = 47,5), subscapular (P = 43,5), abdomen (P = 25,1) and biceps (P = 16,0). Significant decreases in the post-test results only occurred in the biceps ($p < 0,05$) and triceps ($p < 0,01$). The post-test percentile rankings were: suprailiac (P = 49,8), triceps (P = 45,1), subscapular (P = 42,1), abdomen (P = 24,2) and biceps (P = 14,7). The largely non-significant decreases in these skinfold measurements can be attributed to the average scores for body mass (60,6kg) and percentage body fat (25%) attained on the pre-test. Subjects who are considered average in terms of body mass and percentage body fat are less susceptible to changes in body composition (Moody *et al* 1972). In addition, the variety of upper-body movements characteristic of low-impact aerobic dance could account for the significant decreases in the biceps and triceps skinfold measurements obtained after participation in the low-impact aerobic dance programme.

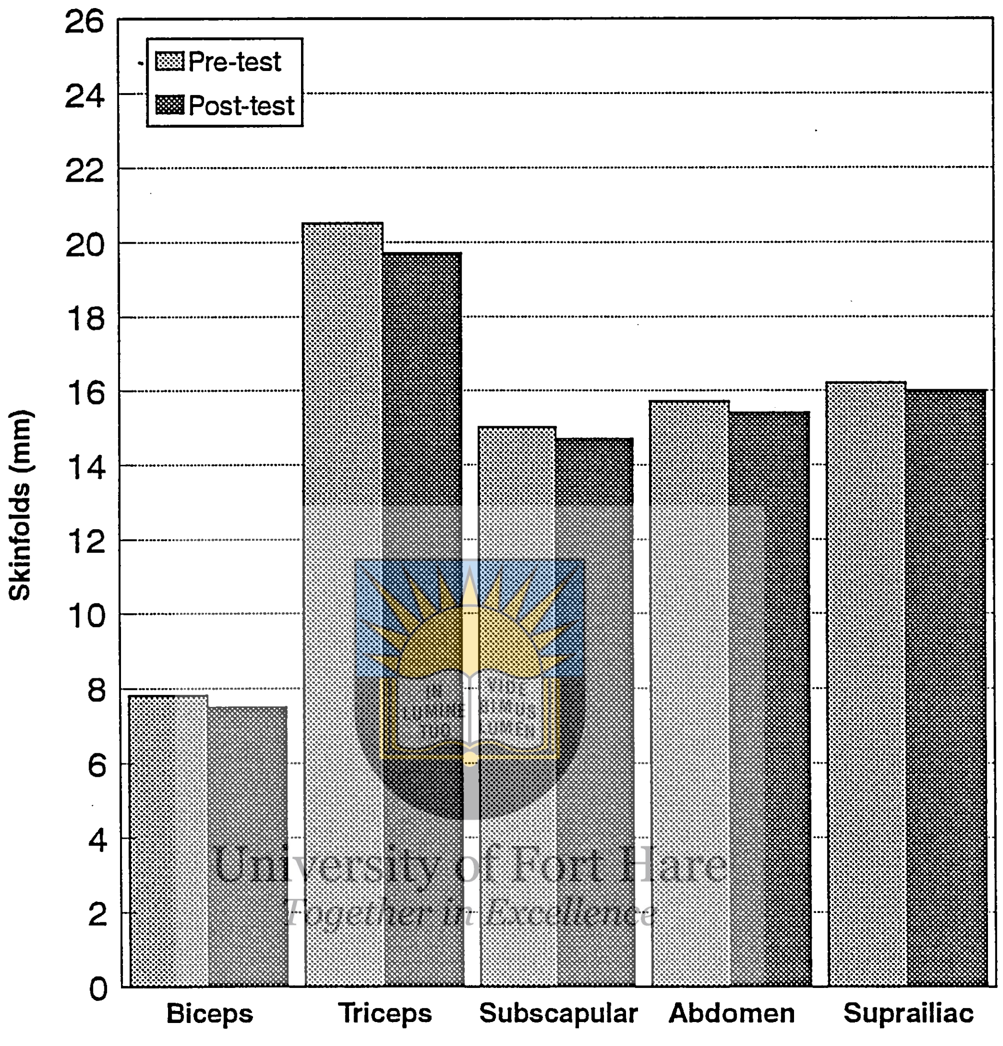


Figure 14: **Pre- and post- skinfold measurements**

D. Summary

The results of the health-related fitness test items revealed that low-impact aerobic dance performed for 50 minutes, three times per week, for ten consecutive weeks, resulted in significant improvements in all components of health-related fitness. The results also indicate that low-impact aerobic dance produces similar cardiorespiratory benefits to those of traditional high-impact aerobic dance if the guidelines for exercise testing and prescription as determined by ACSM (1990) on intensity of the exercise, duration of the exercise session, frequency of the exercise session and rate of progression are adhered to. In addition, no injuries were reported which are commonly associated with traditional high-impact aerobic dance. The significant improvements in the health-related fitness test battery which ranged from 4% to 185% can also be attributed to the poor initial fitness levels of the subjects. This supports the argument that where there is an initially low working capability there is greater potential for improvement (McArdle *et al* (1981), Pollock *et al* 1983).

4.2.3 Health-related Fitness and Self-concept

A. Self-concept and aerobic dance

The pre- and post- test comparison on the Tennessee Self Concept Scale revealed that the subjects scored significantly higher ($p < 0,01$) on seven of the nine subscales of the test, as well as on the total positive or self-concept score (Fig. 15).

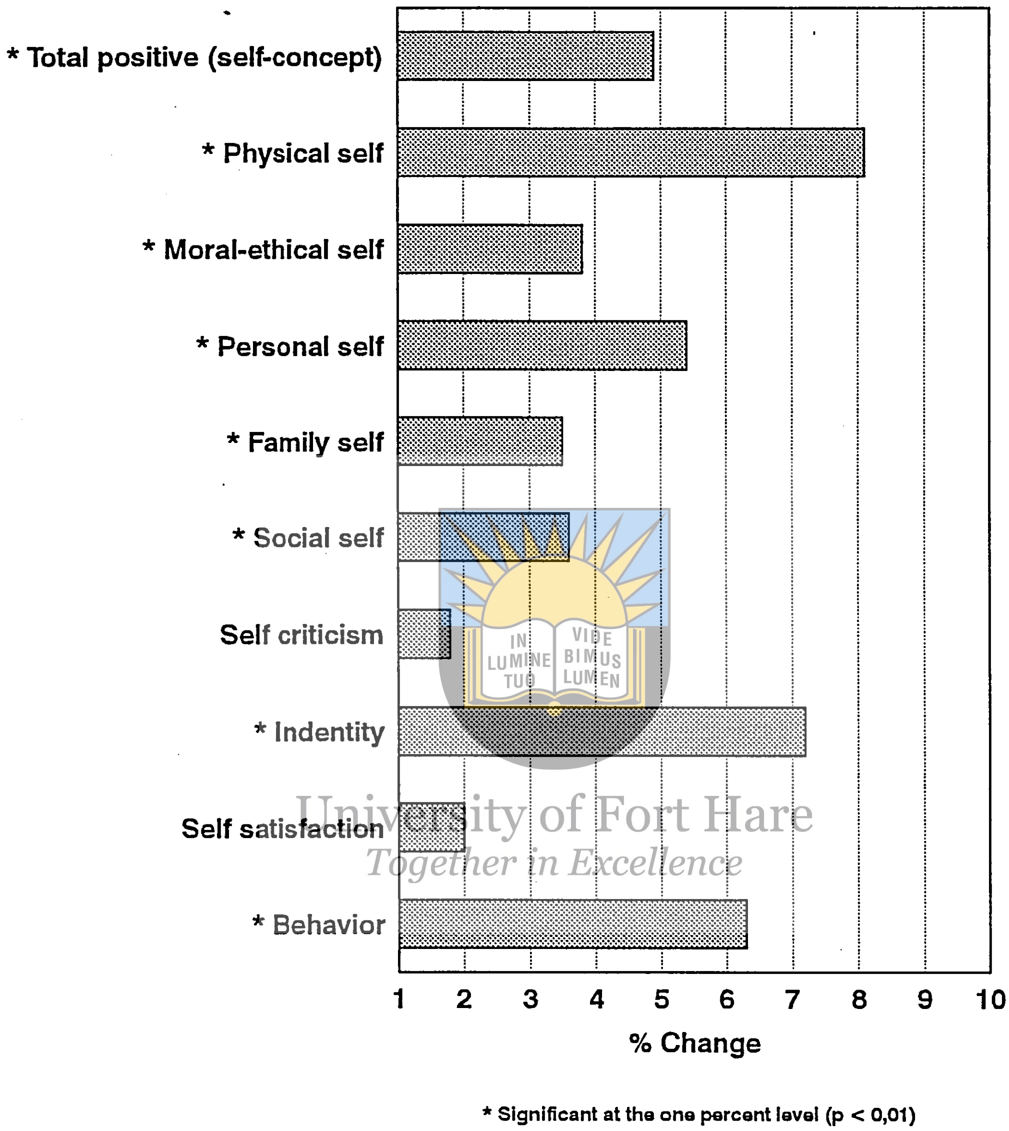


Figure 15: Percentage change of the pre- to post- test scores on the Tennessee Self Concept Scale

The highest percentage improvement was for the physical self (8,14%) which indicates that subjects developed a more positive body image after participation in the low-impact aerobic dance programme. They felt more positive about their bodies, state of health, physical appearance, skills and physical ability. Harris (1985) indicates that embarking on a regular exercise routine can frequently result in changes in habits such as eating, sleeping and energy level, leading to a generally more healthy lifestyle which would account for the significant improvement in the physical self after participation in the low-impact aerobic dance programme. This significant improvement in the physical self is in keeping with the significant improvement ($p < 0{,}01$) in body cathexis which revealed that the subjects rated their body parts and processes very positively after the low-impact aerobic dance programme. According to Harris (1985) regular participation in exercise puts people more "in tune" with their bodies as well as making them more aware of what is happening within the body. In the present study, exercises were selected for specific muscle groups (for example, triceps, biceps, inner thighs, outer thighs, abdomen, etc.), drawing attention to specific parts of the body, thus leading to a greater understanding and appreciation of the body in general.

According to Harris (1985) exercise and physical activity can provide opportunities to develop self-awareness through the integration of body, mind and feelings. Becoming aware of what is happening within the body intensifies the experience and increases one's awareness. This awareness provides a type of feedback that produces a sense of mastery, control and competence that can be revealed in no other way and can also be seen in other aspects of life (Harris 1985).

In the present study the subjects felt more positive in the post-test about their moral-ethical self (moral worth, relationship to God, feelings of being a "good" or "bad" person); personal self (sense of personal worth); family self (feelings of adequacy, worth and value as a family member); social self (sense of adequacy and worth in social interaction with others); identity (how they see themselves) and behaviour (perception of their behaviour and how they function). In addition, the significant improvement in the total positive score reflects the overall level of self-esteem. Thus, participation in the low-impact aerobic dance programme was associated with positive feelings about themselves, a positive self-concept, which in turn would guide and influence them in relationships towards others.

No significant change was recorded on the self criticism and self satisfaction subscales. A significant difference on the self criticism scale would have made interpretation of the other results difficult since this subscale tests the honesty of the subjects' responses. No differences were found in the mean scores on the self satisfaction scale which indicates that the level self acceptance of the subjects was not significantly improved, or that they had ideals which were not fulfilled.

These results are supported by Plummer and Koh (1987) and Berryman-Miller (1988). In the Plummer and Koh (1987) study the aerobic dance group scored higher in seven of the nine subscales of the Tennessee Self Concept Scale, as well as on the total positive score or global self-concept. No significant difference in mean scores was found for the self criticism and moral-ethical subscales. In the Berryman-Miller (1988) study the mean scores on specific items in the Tennessee Self Concept Scale indicated that the experimental group possessed stronger self-concept in the areas of physical self and personal self after the participation in a dance/movement programme.

Even though Eickhoff *et al* (1983) revealed no overall change in the total positive score and physical self score as measured by the Tennessee Self Concept Scale, their secondary finding is relevant to the present study. Their results indicated that physical self scores improved significantly ($p < 0,05$) for those aerobic dancers who were initially classified as "low fit". These findings suggest that among "psychologically healthy" subjects, the initial physical fitness level was a principle determinant of whether such psychological profiles were improved by a particular exercise programme. Bearing this in mind, the subjects in the present study could be classified as "low fit", with VO_{2max} scores of 28,23 $ml.kg^{-1}.min^{-1}$ on the pre-test, and hence the improvement in the self-concept is the be expected.

The pre- and post- test comparison of the body cathexis data revealed that the subjects rated their body parts and processes very positively after the low-impact aerobic dance programme. Only a few items on the scale did not change significantly. These included hair, distribution of hair, breathing, ears, chin, age, eyes and sex organs (Fig. 16). However, the mean pre-scores indicated that the subjects had "moderate positive feelings" towards those items before participation in the aerobic dance programme and were thus satisfied with these body parts and processes.

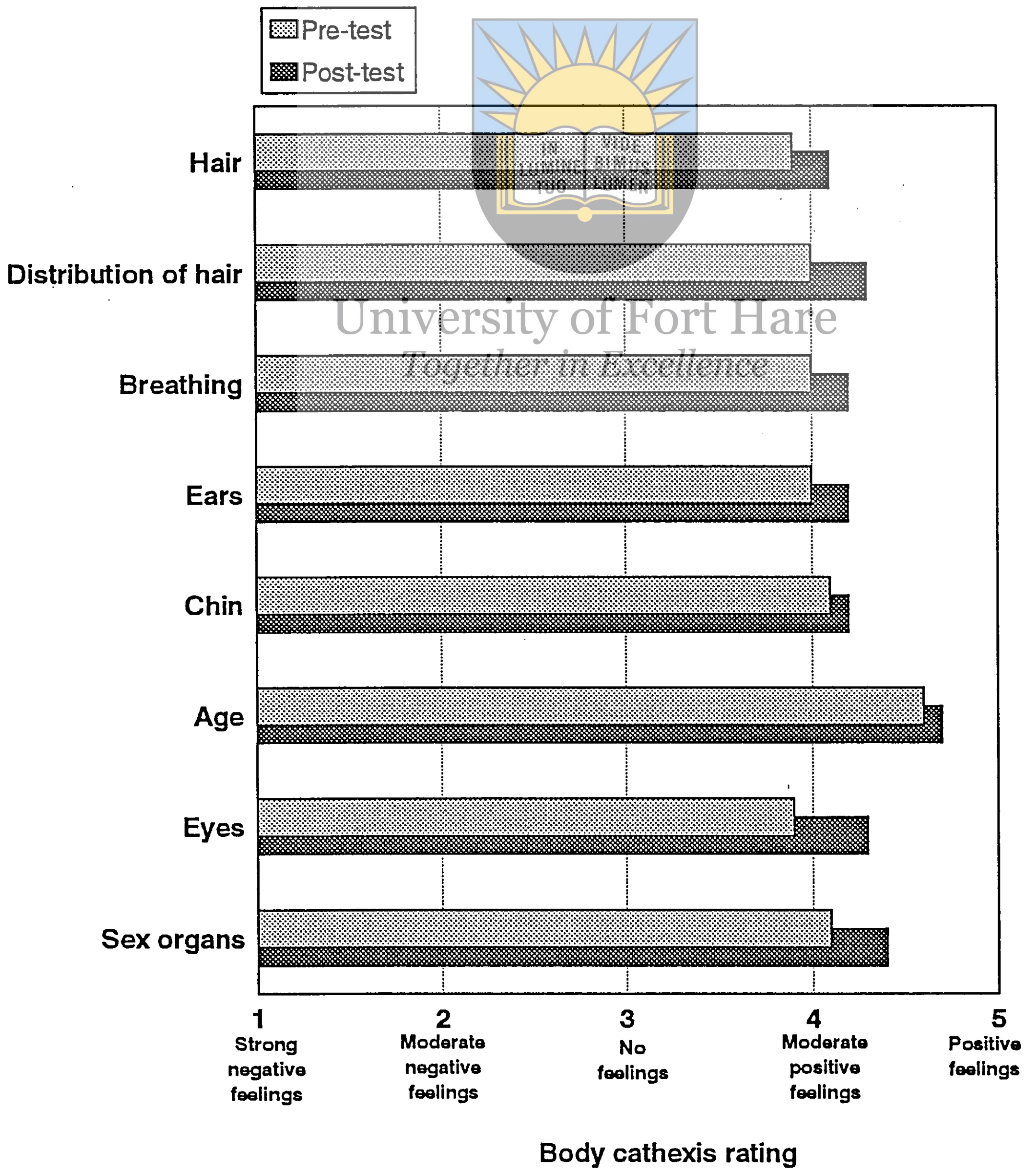


Figure 16: Body cathexis items which did not change significantly

No items were rated "strongly negative" by the subjects. Items which were rated "moderately negative" on the pre-test were hips and weight whereas buttocks and thighs were rated closer to "no feeling" (Fig. 17). On the post-test all these items improved significantly ($p < 0,01$).

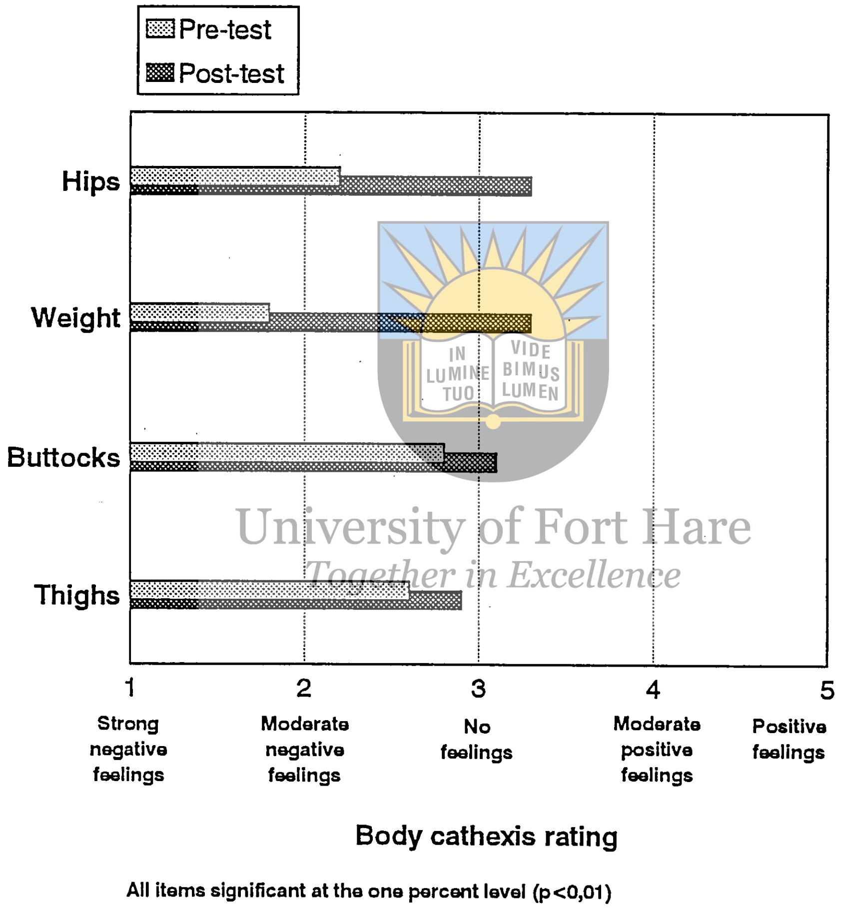


Figure 17: Body cathexis items rated "moderate negative feelings" and "no feelings" on the pre-test

The fact that the subjects rated their weight negatively contradicts the views of Abramson *et al* (1961) and Adadevoh (1974) who indicated that obesity and stoutness were perceived as a symbol of prosperity or beauty in African culture. The subjects' feelings about weight, however, was more in keeping with the Australian, European and North American culture which views slenderness as the "ideal" body shape for women. The media, in the form of fashion magazines, television advertisements and programmes, tend to reinforce slenderness as the western "ideal" body shape for women which could be an influencing factor for other cultures.

Hips, buttocks and thighs tend to be problem areas for many women as can be seen in many magazines, aerobic dance videos, advertisements for exercise programmes, weight loss literature and in the many exercise products which claim to have solutions to these proble ms. These are areas most prone to gaining weight, resulting in "unsightly" bulges. In addition, many of the fashionable clothes of today require narrow hips, small buttocks and slender thighs. People are influenced by fashion and if the fashion draws attention to particular body parts it make them more conscious and aware of those parts. This explains the dissatisfaction the subjects felt towards those body parts which did not conform to the "ideal". The subjects did, however, feel more positively towards these body parts after the participation in the low-impact aerobic dance programme, even though the anthropometric changes to those parts may not have been significant.

The subjects had "no feelings" towards the following items on the pre-test: appetite, elimination, waist, energy level, body build, arms, digestion, skin texture, legs, feet and trunk (Fig. 18). On the post-test, the subjects developed "moderately positive feelings" towards these parts and processes. A regular exercise programme frequently causes changes in habits such as eating and sleeping, resulting in a more healthy overall life pattern. In addition to developing a more positive body image, people frequently view life more favourably (Harris 1985). This could explain the positive feelings the subjects developed towards items which were previously rated "no feelings".

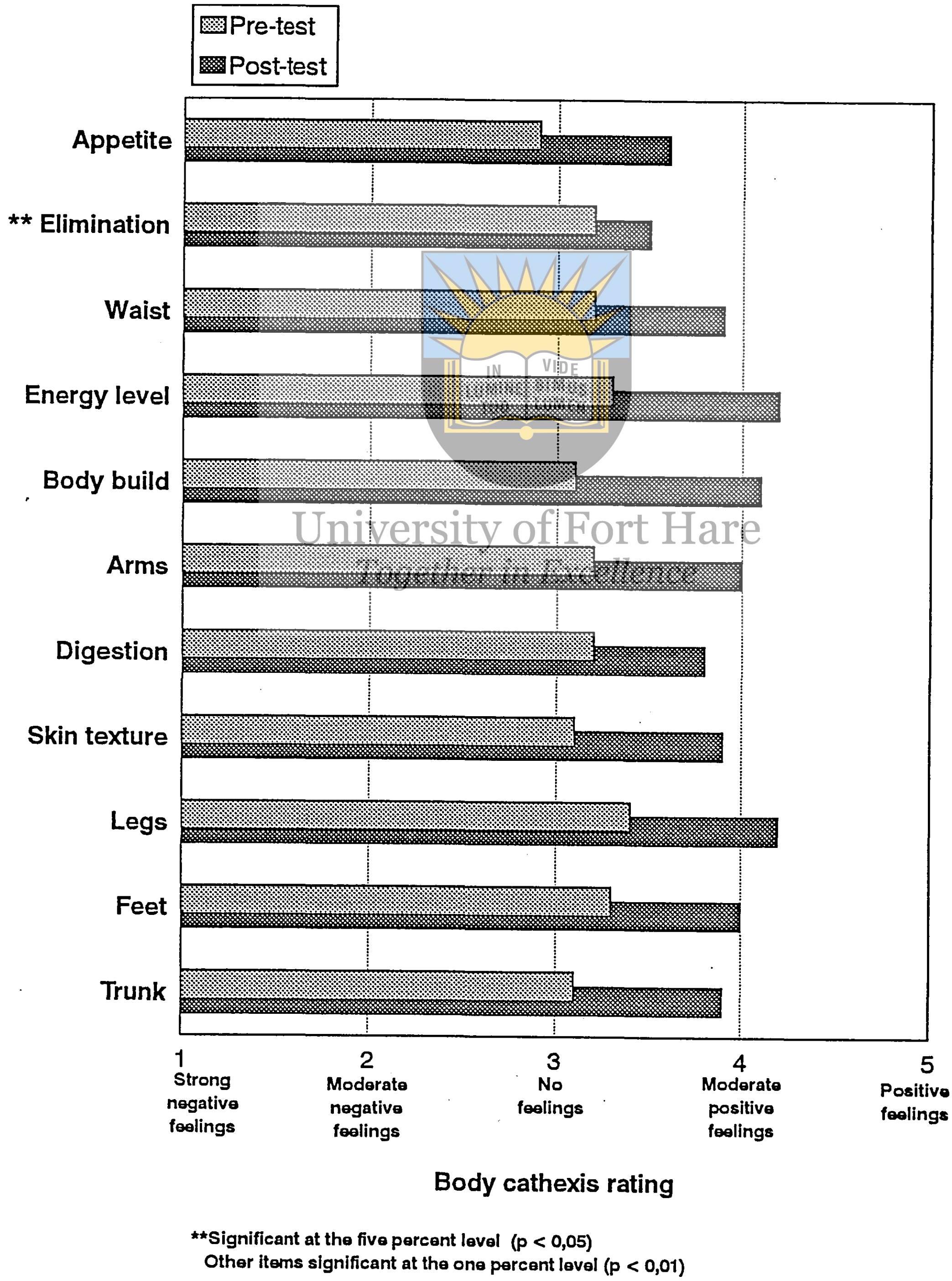


Figure 18: Body cathexis items rated "no feelings" on the pre-test

Fig. 19 and Fig. 20 highlight those items which were initially rated "moderately positive" on the pre-test and which increased significantly ($p < 0{,}01$ and $p < 0{,}05$). However, the post-test scores still fall within the "moderately positive" rating. Exercise was the only item which was rated "moderately positive" on the pre-test and which increased significantly ($p < 0{,}01$) to be rated "strongly positive" on the post-test. It is understandable that exercise was rated "strongly positive" after participation in the low-impact aerobic dance programme. The subjects who volunteered for the study were sedentary. Their high adherence to the programme (97%) and their eagerness to make up missed sessions is an indication of their enjoyment and commitment to the programme. In addition, their spontaneous participation by clapping their hands and clicking their fingers to the beat of the music, their laughter and applause during the programme are an indication of the positive feelings towards the low-impact aerobic dance programme which could account for their positive view of exercise in general.

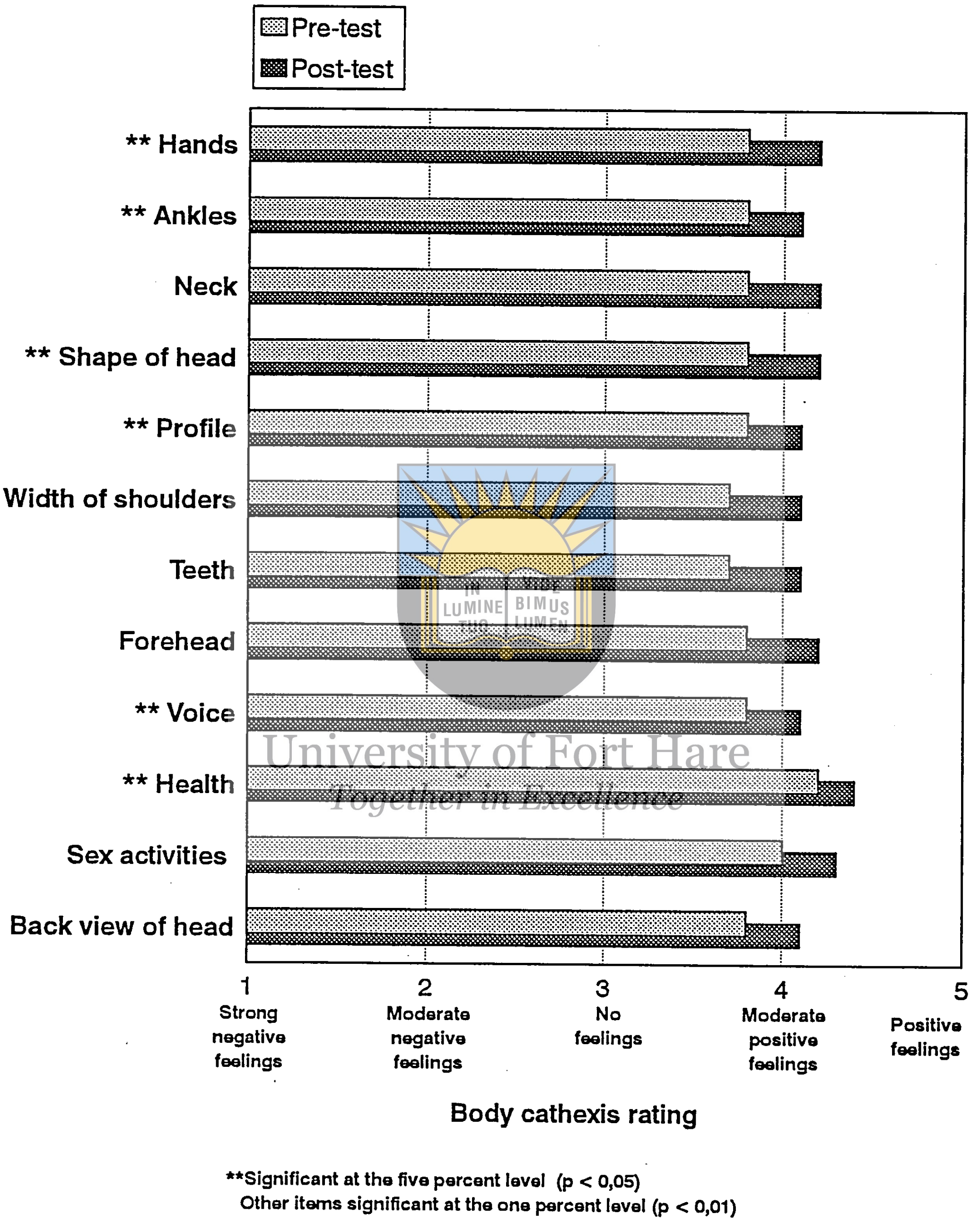


Figure 19: Body cathexis items rated "moderate positive feelings" on the pre-test and which improved less than 12% on the post-test

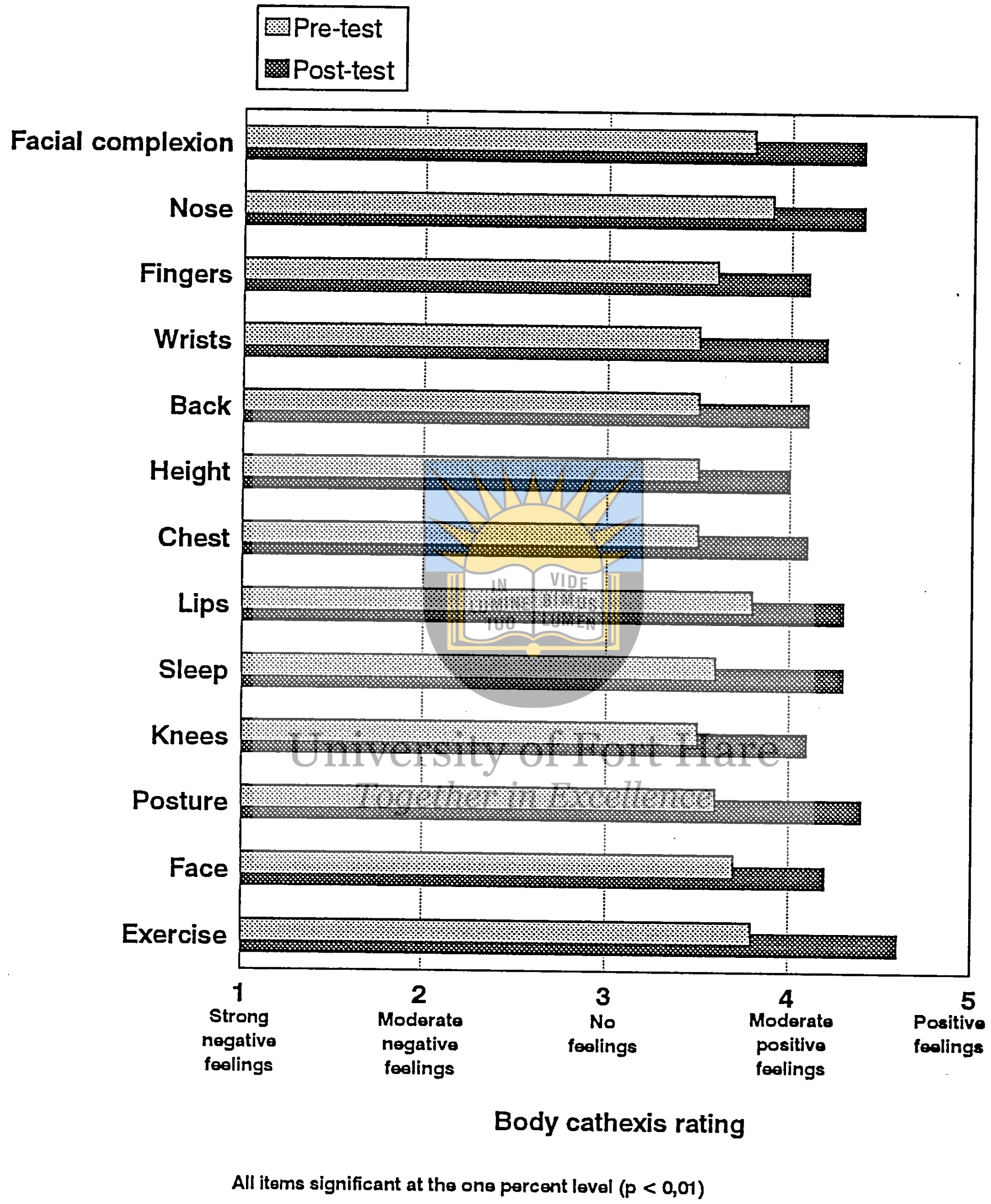


Figure 20: Body cathexis items rated "moderate positive feelings" on the pre-test and which improved more than 12% on the post-test

The total sum or body cathexis score increased significantly ($p < 0,01$) from 170,2 ± 21,93 to 195,2 ± 18,23 (14,7%). The overall results indicated that the subjects developed more positive feelings towards their body parts and processes after participation in the low-impact aerobic dance programme. Even items which are genetically determined and which cannot change through exercise, for example, facial complexion, nose, fingers, shape of head, profile, height, eyes, skin texture, lips, teeth, forehead, feet, voice and back view of head, were viewed more positively by the subjects after the low-impact aerobic dance participation. In addition, bodily processes which are not directly associated with exercise such as: appetite, elimination, breathing, energy level, digestion, sleep and sex activities also improved significantly. These results thus indicated that the subjects viewed their physical appearance in a more positive light, that is, they developed a more positive body image as a result of participation in the low-impact aerobic dance programme. According to Harris (1985), embarking on a regular exercise routine may cause changes to eating and sleeping habits resulting in a more healthy lifestyle overall which in turn could positively influence one's psychological well-being.

The only reported investigation on body cathexis and aerobic dance is the study by Ward and McKeown (1988). Their results, however, indicated that aerobic dance had a minimal effect on body composition and body cathexis. However, the authors indicated that the aerobic dance programme studied was a physical education course that was used to meet a university requirement. Therefore, these findings may not have been representative of those occurring in commercial programmes where individuals participate for reasons other than a course credit. In the present study the subjects were volunteers who eagerly wished to participate in the low-impact aerobic dance programme which may be a reason for the positive results recorded in the present study and not in the study by Ward and McKeown (1988).

B. Relationship between self-concept and health-related fitness

Tables 8 and 9 highlight the pre- and post-test correlation between measures of self-concept and health-related fitness. The results indicated that the self-concept (as represented by the total positive score) was not significantly related to any of the health-related fitness indices in both the pre- and the post-tests. These findings did not support the research hypothesis.

However, a number of studies have also shown that no significant associations exist between measurements of physical fitness and self-concept (Johnson 1969, Neale *et al* 1969, Christian 1970, Sebold 1977, Leonardson and Gargiulo 1978). Heaps (1978) and Leonardson and Gargiulo (1978) asked subjects to rate their physical fitness levels and found that these self-perceptions of personal physical fitness correlated significantly with both physical fitness and global self-concept. In the present study it may be that the subjects' perceptions or attitude about their fitness, rather than the actual fitness itself, was related to favourable emotional adjustment. However, this was not investigated in the study. In addition, Wilfley and Kunce (1986) have shown that the most beneficial exercise effects occur for subjects who are less physically fit and who are experiencing higher levels of stress, aspects which were not investigated in the present study.

Many of the correlational studies are relatively old, dating back to 1969 when the definition of physical fitness and its components were still under much debate. Physical fitness was defined in broad terms and the older test batteries included components, not only of strength and endurance, but also of speed, power and agility. These abilities are more indicative of motor fitness than physical fitness (Baumgartner and Jackson 1982). It was only later that widely acceptable fitness test batteries were established by the American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD), (Safrit 1986). Many of the studies employed test batteries that evaluated cardiorespiratory endurance, dexterity (motor skills) or muscular strength, but failed to access muscular endurance, flexibility and body composition (Johnson 1969, Neale *et al* 1969, Christian 1970, Sebold 1977, Heaps 1978, Leonardson and Gargiulo 1978). Balogun (1987), the only reported study to have determined the relationship of all five measures of physical fitness and self-concept, found that self-concept was positively related to flexibility and inversely related to percentage body fat. No correlation between self-concept and muscular endurance and strength or cardiorespiratory fitness was found.

The correlation between self-concept and body-image was statistically significant ($p < 0{,}01$) in both the pre- and the post-tests. Also, a significant correlation ($p < 0{,}01$) was found between self-concept and body cathexis in the post-test. This finding supports the research by Secord and Jourard (1953) who found that body cathexis correlated 0,58 and 0,66 with self cathexis in college males and females. Additionally, low body cathexis was associated with higher levels of chronic anxiety. Berscheid *et al* (1973) found that in both sexes, body image was highly related to self-esteem. Only 11% of people with below average body images had above average levels of self-esteem. The body thus seems to be the most apparent component of the self and it is likely that body image may be a viable predictor of self-concept. Other personal attributes like intelligence, beauty and physical skills may be important in shaping self-concept (Sonstroem 1982, Balogun 1987).

The multiple stepwise regression analysis for the total positive data revealed that the five fitness parameters considered in this investigation were not significant predictors of self-concept. This finding is consistent with previous reports (Neale *et al* 1969, Christian 1970, Leonardson and Gargiulo 1978, Balogun 1987). Results of the multiple stepwise regression analysis revealed that the self-concept of adult females could be attributed to factors other than health-related fitness. As discussed earlier it may be that the subjects' perception or attitudes about their fitness, rather than the actual fitness itself, was related to favourable emotional adjustment.

C. Summary

The results of the Tennessee Self Concept Scale revealed significant improvements ($p < 0{,}01$) in seven of the nine subscales as well as in the total positive or self-concept score. The subscales are: physical self, moral-ethical self, personal self, family self, social self, identity and behaviour. These results are supported by Plummer and Koh (1987) and Berryman-Miller (1988). The pre- and post-test comparison of the body cathexis data revealed that the subjects rated their body parts and processes very positively after the low-impact aerobic dance programme. A regular exercise programme frequently causes changes in habits such as eating and sleeping, resulting in a generally more healthy life pattern (Harris 1985). Exercise and physical activity can provide opportunities to develop self-awareness through the integration of body, mind and feelings. Becoming aware of what is happening within the body intensifies the experience and increases one's awareness. This awareness provides feedback that produces a sense of mastery, control and competence that can be revealed in no other way and is beneficial in general life skills (Harris 1985). Thus, participation in a low-impact aerobic dance programme enhances self-concept and has wider consequent benefits in social interactions.

In the relationship between self-concept and health-related fitness none of the fitness components were found to be related to the self-concept, which was also supported by Johnson (1969), Neale *et al* (1969), Christian (1970), Sebold (1977) and Leonardson and Gargiulo (1978). The multiple stepwise regression analysis for the total positive data revealed that the five fitness parameters considered in this investigation were not significant predictors of self-concept. This finding is consistent with previous reports (Neale *et al* 1969, Christian 1970, Leonardson and Gargiulo 1978, Balogun 1987). Thus, even though there was a significant improvement in self-concept after participation in the low-impact aerobic dance programme, it was not the resultant fitness which was responsible for this improvement.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary
- **Procedures**
- **Results**

Conclusions
Recommendations

Over the past twenty years there has been a worldwide surge in public awareness of the need for regular exercise in order to maintain optimum health (Balogun 1987). This growth in exercise awareness and participation has led to the popularization of a new form of physical activity, aerobic dance (Warrick and Tinning 1989a). Recently, a modification of traditional aerobic dance has evolved called "low-impact" aerobic dance. In this approach, one foot maintains contact with the floor at all times, thereby eliminating the suspension phase of the activity. Low-impact aerobic dance reduces the amount of impact shock claimed to be associated with injuries in traditional aerobic dance (McCord *et al* 1989).

A paucity of research presently exists on the physiological and psychological effects of low-impact aerobic dance. The purpose of this study was to determine the effects of low-impact aerobic dance participation on the health-related fitness and the self-concept of female students at the University of Fort Hare. Specifically, the various components of health-related fitness, namely, cardiorespiratory function, musculoskeletal function and body composition, were measured to determine which of these components were significantly affected by a ten week low-impact aerobic dance programme. Furthermore, the self-concept of each student was measured before and after the programme to determine if any changes occurred as a result of participation in low-impact aerobic dance. The relationship between the components of health-related fitness and self-concept was also examined.

5.1 SUMMARY

5.1.1 Procedures

Forty female students studying at the University of Fort Hare volunteered for the study. The subjects participated three times per week for ten consecutive weeks in a low-impact aerobic dance programme. They also agreed not to exercise outside of class time and not to change their eating habits.

The subjects were pre-tested one week prior to beginning the training programme and post-tested within one week of the completion of the training programme. A battery of health-related fitness tests to measure cardiorespiratory and musculoskeletal functions and body composition was performed. Cardiorespiratory function was measured using the Golding *et al* (1989) bicycle ergometer submaximal protocol to predict VO_{2max}. Musculoskeletal function was measured using the following tests: strength tests (grip, leg and back); muscular endurance tests (one-minute sit-ups and the flexed-arm hang); power test (the standing long jump) and flexibility test (the sit-and-reach). Body composition was assessed using the sum of the triceps, suprailium and thigh skinfolds to estimate the percentage body fat for the subjects (Pollack *et al* 1980). In addition, the biceps, triceps, subscapular, abdominal and suprailiac skinfold measurements were taken to enable comparisons to be made with the national fitness norms drawn up by Andrews (1990). The psychological tests administered to the subjects were the Counselling Form of the Tennessee Self Concept Scale (Fitts 1965) and the Body Cathexis Scale (Secord and Jourard 1953).

Statistical analysis of these data was performed in order to determine the statistical significance between pre- and post-tests, the strength of the relationship between the self-concept and fitness indices, as well as the predictive strength of the fitness indices.

5.1.2 Results

Thirty-seven of the 40 subjects completed the study with a 97% attendance. Twenty-one (57%) of the 37 subjects had 100% attendance.

A. Health-related fitness tests

The results of the health-related fitness test items revealed that low-impact aerobic dance performed for 50 minutes, three times per week, for ten consecutive weeks, resulted in significant improvements ($p < 0{,}01$) in all components of health-related fitness:

- VO_{2max} improved from 28,22 ± 3,40 $ml.kg^{-1}.min^{-1}$ to 33,06 ± 3,35 $ml.kg^{-1}.min^{-1}$, a percentage improvement of 17%;
- improvements ranging from 4% to 18% were obtained in all the strength tests — right grip (32,19 ± 4,64kg to 33,53 ± 3,99kg), left grip (29,72 ± 4,93kg to 31,49 ± 4,66kg), back (78,08 ± 15,60kg to 91,95 ± 16,17kg), leg (73,97 ± 19,71kg to 87,46 ± 18,28kg) and the strength/mass ratio (3,56 ± 0,67kg to 4,09 ± 0,70kg);
- improvements were obtained in the muscular endurance tests, the 1-minute sit-ups increased by 67% from 19,7 ± 8,79 to 32,8 ± 8,46 and the flexed arm hang increased by 185% from 2,9 ± 5,46s to 8,2 ± 9,35s;
- the standing long jump power test scores increased by 8% from 140,4 ± 13,65cm to 152,1 ± 14,66cm;
- the sit-and-reach flexibility test scores increased by 4% from 37,4 ± 5,03cm to 39,0 ± 4,64cm and
- percentage body fat decreased by 2% from 25,5 ± 3,04% to 25,0 ± 3,05%.

The significant improvements in the health-related fitness test items support the view of McArdle *et al* (1981) and Pollock *et al* (1983) that where there is an initially low working capability there is greater capacity for improvement.

B. Health-related fitness and self-concept

i. Self-concept and aerobic dance

The pre- and post-test comparison of the Tennessee Self Concept Scale revealed that the subjects scored significantly higher ($p < 0{,}01$) on seven of the nine subscales of the test (physical self, moral-ethical self, personal self, family self, social self, identity, behaviour), as well as on the total positive or self-concept score. In the Body Cathexis test significant changes ($p < 0{,}01$ and $p < 0{,}05$) occurred for 83% of the items on the scale. Thus, participation in the low-impact aerobic dance programme is associated with an improved self-concept and body image and has wide consequent benefits in social interactions.

ii. Relationship between self-concept and health-related fitness

In the analysis of the relationship between self-concept and health-related fitness, none of the fitness components were significantly related to self-concept. The multiple stepwise regression analysis for the total positive data revealed that none of the fitness parameters were significant predictors of self-concept. Thus, even though there was a significant improvement in self-concept after participation in the low-impact aerobic dance programme, the resultant fitness was not shown to be responsible for this improvement.

5.2 CONCLUSIONS

Based on the results of this study it can be concluded that:

- participation three times a week for ten weeks in a low-impact aerobic dance programme results in significant improvements in health-related fitness and self-concept, and
- there is no correlation between health-related fitness and self-concept.

5.3 RECOMMENDATIONS

Based on the results of the present study and previous related research reviewed, the following recommendations are presented for further study:

- Further research on the effects of low-impact aerobic dance should not only focus on cardiorespiratory fitness, but on the other components of health-related fitness as well.
- To fully understand the effects of aerobic dance training on body composition, aerobic dance training studies should be of longer duration.
- Future research should also assess the health-related fitness benefits of the innovations to aerobic dance (water aerobics, assisted aerobics and step aerobics).
- Further research should investigate the reasons for the improvement in psychological well-being which results from participation in aerobic dance.

This may require investigation into the unique psycho-social milieu that exists in these classes.

- The physiological effects of aerobic dance could be further analysed using laboratory rather than field tests.

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APPENDICES

Appendix A: Medical history questionnaire

MEDICAL HISTORY QUESTIONNAIRE

NAME: ____

DATE OF BIRTH: __________________

1. Do you experience shortness of breath or loss of breath while walking? Yes No

2. Do you ever experience sudden tingling, numbness, or loss of feeling in your arms, hands, legs, feet or face? Yes No

3. Do you get pains or cramps in your legs when going about your daily routine? Yes No

4. Do you ever experience any pain or discomfort in your chest? Yes No

5. Have you ever been told that your cholesterol is high? Yes No

6. Have you had rheumatic fever? Yes No

7. Do you smoke? Yes No

8. Have you stopped smoking in the last year? Yes No

9. Are you currently on any medication? Yes No

If yes, please specify:

____

____

____

10. Have you ever been told you have any of the following?

Diabetes	Yes	No
Heart disease	Yes	No
High blood pressure	Yes	No
Angina	Yes	No
Heart murmur	Yes	No
Asthma	Yes	No

11. Has any member of your immediate family been treated for or had any of these listed below? Please identify their relationship to you (father, mother, sister, brother).

Diabetes	________________	Yes	No
Heart disease	________________	Yes	No
Stroke	________________	Yes	No
High blood pressure	________________	Yes	No

I, ____ hereby declare that the above responses are truthful and accurate, to the best of my knowledge.

______________________________ ________________

SIGNATURE DATE

Appendix B: Informed consent statement

CONSENT FOR EXPERIMENTAL PROCEDURE

Title of Research

The Effects of Low-Impact Aerobic Dance on the Health-related Fitness and Self Concept of Female Students at the University of Fort Hare.

Purpose of the Research

The purpose of this study is to determine the effects of a low-impact aerobic dance programme on the health-related fitness and self concept on female students. Initial levels of health-related fitness and the measurement of self concept will be obtained. Subjects would then participate in a ten-week aerobic dance programme, after which health-related fitness levels and measurements of the self concept will again be assessed, to establish possible changes as a result of participation in the exercise programme.

Description of the Experiment

Exercise Programme

You will be required to participate in a low-impact aerobic dance programme for ten weeks (three times a week). The aerobic dance programme will comprize of a thorough warming up section of stretching exercises, exercises to improve muscular strength and endurance of the major muscle groups of the body, cardiorespiratory endurance, and a cooling down routine.

Physiological Tests

The following tests will be conducted before and after the exercise programme:

1. Cardiorespiratory fitness will be estimated from a submaximal cyclegometer test or assessed using a progressive treadmill test.

2. Muscular strength will be determined using the grip, leg and back dynamometer tests.

3. Muscular endurance will be determined using the 1-minute sit-up test and the flexed arm hang test.

4. Flexibility will be assessed using the sit-and-reach test.

5. Body composition will be established using skinfold measurements.

Psychological Tests

Self Concept and Body Cathexis tests will be administered before and after the exercise programme.

Risks and Discomfort

There will be no exposure to dangerous or hazardous circumstances. Experimental procedures will emphasize safety, and subjects will not be asked to perform any task not related to the collection of data. The subject may experience tiredness and muscle soreness in the early exercise sessions, but these may only be temporary, and improve as fitness levels increase. Subjects will also get individual attention in so far as the correct execution of the exercises, to minimize the likelihood of sustaining injury as a result of participating in the exercise programme.

Benefits

By participating in this study, you will obtain information about your current state of fitness as well as an appraisal of your body composition. How these factors correlate with the measurement of self concept will also be ascertained. You will also enjoy the benefits of participating in an aerobic dance programme. Lastly, the results may provide valuable information on the interrelationship between measures of health-related fitness and the self concept of female university students.

Confidentiality

This information will be used for scientific purposes, including conference presentations and publications, only. Records are kept strictly confidential unless you consent to release this information. Subjects will not be identified in any reports of this study without prior consent.

Management of Physical Injury

In the event that physical injury occurs during the data collection, the University of Fort Hare and the investigators do not automatically provide reimbursement for medical care or other compensation. Investigators are skilled in first aid and will make every effort to minimize the effects of the injury. Any physical injury suffered during the study must be reported to Cheryl Walter.

Enquiries

Questions about the procedures used in the above-mentioned tests are encouraged. If you have any questions or need additional information, please ask for further explanations.

Freedom of Consent

Your permission to perform these tests is strictly voluntary. You are free to deny consent if you so desire. Should you decide to participate, you are free to withdraw consent and to discontinue participation in the study at anytime, without prejudice.

Subject Consent

I have read this form carefully. Cheryl Walter has offered to answer any questions I may have concerning the study. I hereby consent to participate in the exercise programme and the tests. My signature indicates that I have received a copy of this consent form, and accept responsibility for the minimal risk involved in the study.

Name (Please print) ______________________

Address ______________________

____

____

Consenting Signature ______________________

Date ______________________

______________________ ______________________

Witness Date

______________________ ______________________

Witness Date

Appendix C: Health-related fitness data collection sheet

HEALTH-RELATED FITNESS DATA

1. Personal Data

1.1 Name : ______________________________

1.2 Date of Birth :

				1	9		

1.3 Degree/Diploma being studied : ______________________

Year of Study : __________

Major Courses : 1. ____________ 2. ____________

2. Physiological Data

2.1 **Flexibility (cm) : Sit-and-Reach**

Trial 1 [|]

Trial 2 [|] Flexibility [|]

Trial 3 [|]

2.2 **Muscular Endurance :**

Sit-ups (1 minute) [|]

Flexed arm hang (sec) [|]

2.3 **Strength :**

Grip Strength — Right (kg) :

Trial 1 | | |

Trial 2 | | | Grip Strength (right) | | |

Trial 3 | | |

Grip Strength — Left (kg) :

Trial 1 | | |

Trial 2 | | | Grip Strength (left) | | |

Trial 3 | | |

Back Strength (kg) :

Trial 1 | | | |

Trial 2 | | | | Back Strength | | | |

Trial 3 | | | |

Leg Strength (kg) :

Trial 1 | | | |

Trial 2 | | | | Leg Strength | | | |

Trial 3 | | | |

2.4 **Standing Long Jump (cm)**

Trial 1 | | | |

Trial 2 | | | |

Long Jump | | | |

2.5 **Body Composition**

Body mass (kg) | | | | |

Height (cm) | | | | |

Skinfolds (mm)

Triceps : | | |

Suprailiac : | | |

Sum : | | |

Thigh : | | |

Biceps : | | |

Triceps : | | |

Subscapular : | | |

Abdomen : | | |

Suprailiac : | | |

2.6 Cardiorespiratory Fitness

VO_{2max}

Predicted HR max __________ bpm Seat Setting __________

Minute	Heart Rate	Workload
1	________	________
2	________	________
3	________	________
4	________	________
5	________	________
6	________	________
7	________	________
8	________	________
9	________	________
10	________	________
11	________	________
12	________	________

Physical Work Capacity : [ ][ ][ ][ ] kpm/min

Predicted VO_{2max} : [ ][ ] l/min

Appendix D: Form for plotting VO_{2max} prediction

MAXIMUM PHYSICAL WORKING CAPACITY PREDICTION

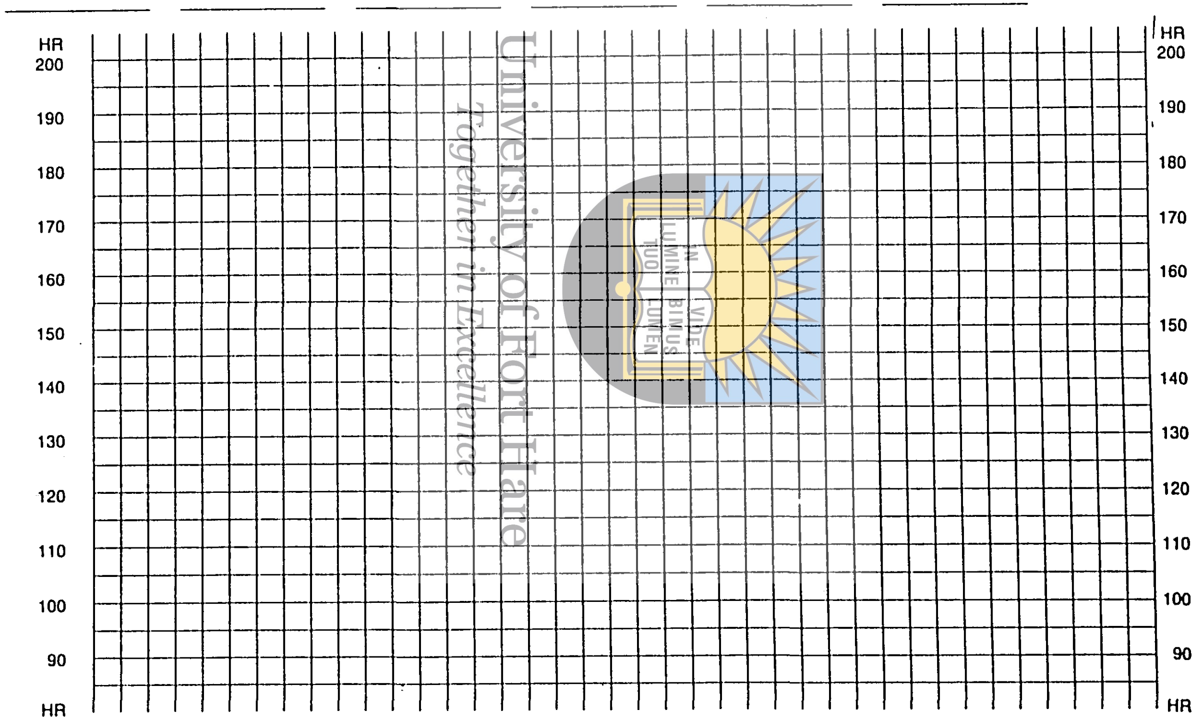
Name ______________________ Age ________ Weight ________ Lb ________ Kg   Seat height ____________

Predicted max HR ________

	Date	1st work load HR used	2nd work load HR used	Max work load	Max O_2(L/min)	Max O_2(L/kg)
Test 1						
Test 2						
Test 3						

DIRECTIONS

1. Plot the HR of the 2 work loads versus the work (kgm/min).
2. Determine the subject's max HR line by subtracting subject's age from 220 and draw a line across the graph at this value.
3. Draw a line through both points and extend to the max HR line for age.
4. Drop a line from this point to the baseline and read the predicted max work load and O_2 uptake.



Work load (kgm/min)	150	300	450	600	750	900	1050	1200	1350	1500	1650	1800	1950	2100
Max O_2 uptake (L/m)	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.8	3.2	3.5	3.8	4.2	4.6	5.0
Kcal used (kcal/m)	3.0	4.5	6.0	7.5	9.0	10.5	12.0	14.0	16.0	17.5	19.0	21.0	23.0	25.0
Approx MET level (for 132 lb)	3.3	4.7	6.0	7.3	8.7	10.0	11.3	12.7	14.0	15.3	16.7	18.0	19.3	20.7
Approx MET level (for 176 lb)	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	16.0

Appendix E: The counselling form of the Tennessee Self Concept Scale

Name: ....

The statements in this inventory are to help you describe yourself as you see *yourself*. Please answer them as if you were describing yourself to yourself. Read each item carefully; then select one of the five responses below and **encircle the appropriate number.**

Don't skip any items. Answer each one. Use a soft lead pencil. If you change an answer, you must erase the old answer completely and enter the new one.

Responses:

Completely False	Mostly False	Partly False and Partly True	Mostly True	Completely True
1	2	3	4	5

Tennessee Self-Concept Scale

1. I have a healthy body	1	2	3	4	5
2. I am an attractive person	1	2	3	4	5
3. I consider myself a sloppy person	1	2	3	4	5
4. I am a decent sort of person	1	2	3	4	5
5. I am an honest person	1	2	3	4	5
6. I am a bad person	1	2	3	4	5
7. I am a cheerful person	1	2	3	4	5
8. I am a calm and easy going person	1	2	3	4	5
9. I am a nobody	1	2	3	4	5
10. I have a family that would always help me in any kind of trouble	1	2	3	4	5
11. I am a member of a happy family	1	2	3	4	5
12. My friends have no confidence in me	1	2	3	4	5
13. I am a friendly person	1	2	3	4	5
14. I am popular with men	1	2	3	4	5
15. I am not interested in what other people do	1	2	3	4	5
16. I do not always tell the truth	1	2	3	4	5
17. I get angry sometimes	1	2	3	4	5
18. I like to look nice and neat all the time	1	2	3	4	5
19. I am full of aches and pains	1	2	3	4	5
20. I am a sick person	1	2	3	4	5

Completely False	Mostly False	Partly False and Partly True	Mostly True	Completely True
1	2	3	4	5

21. I am a religious person	1	2	3	4	5
22. I am a moral failure	1	2	3	4	5
23. I am a morally weak person	1	2	3	4	5
24. I have a lot of self control	1	2	3	4	5
25. I am a hateful person	1	2	3	4	5
26. I am losing my mind	1	2	3	4	5
27. I am an important person to my friends and family	1	2	3	4	5
28. I am not loved by my family	1	2	3	4	5
29. I feel that my family doesn't trust me	1	2	3	4	5
30. I am popular with women	1	2	3	4	5
31. I am mad at the whole world	1	2	3	4	5
32. I am hard to be friendly with	1	2	3	4	5
33. Once in a while I think of things too bad to talk about	1	2	3	4	5
34. Sometimes when I am not feeling well, I am cross	1	2	3	4	5
35. I am neither too fat nor too thin	1	2	3	4	5
36. I like my looks just the way they are	1	2	3	4	5
37. I would like to change some parts of my body	1	2	3	4	5
38. I am satisfied with my moral behaviour	1	2	3	4	5
39. I am satisfied with my relationship to God	1	2	3	4	5
40. I ought to go to church more	1	2	3	4	5
41. I am satisfied to be just what I am	1	2	3	4	5
42. I am just as nice as I should be	1	2	3	4	5
43. I despise myself	1	2	3	4	5
44. I am satisfied with my family relationships	1	2	3	4	5
45. I understand my family as well as I should	1	2	3	4	5
46. I should trust my family more	1	2	3	4	5
47. I am as sociable as I want to be	1	2	3	4	5
48. I try to please others, but I don't overdo it	1	2	3	4	5
49. I am no good at all from a social standpoint	1	2	3	4	5
50. I do not like everyone I know	1	2	3	4	5

Completely False	Mostly False	Partly False and Partly True	Mostly True	Completely True
1	2	3	4	5

51. Once in a while I laugh at a dirty joke 1 2 3 4 5
52. I am neither too tall nor too short 1 2 3 4 5
53. I don't feel as well as I should 1 2 3 4 5
54. I should have more sex appeal 1 2 3 4 5
55. I am as religious as I want to be 1 2 3 4 5
56. I wish I could be more trustworthy 1 2 3 4 5
57. I shouldn't tell so many lies 1 2 3 4 5
58. I am as smart as I want to be 1 2 3 4 5
59. I am not the person I would like to be 1 2 3 4 5
60. I wish I didn't give up as easily as I do 1 2 3 4 5
61. I treat my parents as well as I should (Use past tense if parents are not living) . 1 2 3 4 5
62. I am too sensitive to things my family say 1 2 3 4 5
63. I should love my family more 1 2 3 4 5
64. I am satisfied with the way I treat other people 1 2 3 4 5
65. I should be more polite to others 1 2 3 4 5
66. I ought to get along better with other people 1 2 3 4 5
67. I gossip a little at times 1 2 3 4 5
68. At times I feel like swearing 1 2 3 4 5
69. I take good care of myself physically 1 2 3 4 5
70. I try to be careful about my appearance 1 2 3 4 5
71. I often act like I am "all thumbs" 1 2 3 4 5
72. I am true to my religion in everyday life 1 2 3 4 5
73. I try to change when I know I'm doing things that are wrong 1 2 3 4 5
74. I sometimes do very bad things 1 2 3 4 5
75. I can always take care of myself in any situation 1 2 3 4 5
76. I take the blame for things without getting mad 1 2 3 4 5
77. I do things without thinking about them first 1 2 3 4 5
78. I try to play fair with my friends and family 1 2 3 4 5
79. I take a real interest in my family 1 2 3 4 5
80. I give in to my parents. (Use past tense if parents are not living) 1 2 3 4 5

Completely False	Mostly False	Partly False and Partly True	Mostly True	Completely True
1	2	3	4	5

81. I try to understand the other person's point of view	1	2	3	4	5
82. I get along well with other people	1	2	3	4	5
83. I do not forgive others easily	1	2	3	4	5
84. I would rather win than lose in a game	1	2	3	4	5
85. I feel good most of the time	1	2	3	4	5
86. I do poorly in sports and games	1	2	3	4	5
87. I am a poor sleeper	1	2	3	4	5
88. I do what is right most of the time	1	2	3	4	5
89. I sometimes use unfair means to get ahead	1	2	3	4	5
90. I have trouble doing the things that are right	1	2	3	4	5
91. I solve my problems quite easily	1	2	3	4	5
92. I change my mind a lot	1	2	3	4	5
93. I try to run away from my problems	1	2	3	4	5
94. I do my share of work at home	1	2	3	4	5
95. I quarrel with my family	1	2	3	4	5
96. I do not act like my family thinks I should	1	2	3	4	5
97. I see good points in all the people I meet	1	2	3	4	5
98. I do not feel at ease with other people	1	2	3	4	5
99. I find it hard to talk with strangers	1	2	3	4	5
100. Once in a while I put off until tomorrow what I ought to do today	1	2	3	4	5

Appendix F: Body Cathexis Scale

Body Cathexis

On the following pages are listed a number of things characteristic of yourself or related to you. You are asked to indicate which things you are satisfied with exactly as they are, which things you worry about and would like to change if they were possible, and which things you have no feelings about one way or the other.
Consider each item listed below and encircle the number which best represents your feelings according to the following scale:

1 — **Have strong negative feelings**
Mark a 1 for those aspects of yourself about which you worry or which you dislike very much or which cause you to feel unhappy when you think about them.

2 — **Have moderate negative feelings**
Mark a 2 for those aspects of yourself about which you have some negative feeling but not as strong as that in category 1. You don't like it but you can put up with it.

3 — **Have no feeling one way or the other**
Mark a 3 for those aspects of yourself about which you have no feeling at all.

4 — **Have moderate positive feelings**
Mark a 4 for those aspects of yourself about which you have some positive feeling, some satisfaction, but not as strong as that in category 5.

5 — **Have strong positive feelings**
Mark a 5 for those aspects of yourself about which you feel proud or happy or which give you a pleasant feeling when you think about them and consider yourself fortunate.

Name: ....

Body Cathexis

1	-	Have strong *negative* feelings
2	-	Have moderate *negative* feelings
3	-	Have no feeling one way or the other
4	-	Have moderate *positive* feelings
5	-	Have strong *positive* feelings

Hair	1	2	3	4	5
Facial complexion	1	2	3	4	5
Appetite	1	2	3	4	5
Hands	1	2	3	4	5
Distribution of hair (over body) ...	1	2	3	4	5
Nose	1	2	3	4	5
Fingers	1	2	3	4	5
Elimination	1	2	3	4	5
Wrists	1	2	3	4	5
Breathing	1	2	3	4	5
Waist	1	2	3	4	5
Energy level	1	2	3	4	5
Back	1	2	3	4	5
Ears	1	2	3	4	5
Chin	1	2	3	4	5
Exercise	1	2	3	4	5
Ankles	1	2	3	4	5
Neck	1	2	3	4	5
Shape of head	1	2	3	4	5
Body build	1	2	3	4	5
Profile	1	2	3	4	5
Height	1	2	3	4	5
Age	1	2	3	4	5

1	-	Have strong *negative* feelings
2	-	Have moderate *negative* feelings
3	-	Have no feeling one way or the other
4	-	Have moderate *positive* feelings
5	-	Have strong *positive* feelings

Width of shoulders	1	2	3	4	5
Arms	1	2	3	4	5
Chest	1	2	3	4	5
Eyes	1	2	3	4	5
Digestion	1	2	3	4	5
Hips	1	2	3	4	5
Skin texture	1	2	3	4	5
Lips	1	2	3	4	5
Legs	1	2	3	4	5
Teeth	1	2	3	4	5
Forehead	1	2	3	4	5
Feet	1	2	3	4	5
Sleep	1	2	3	4	5
Voice	1	2	3	4	5
Health	1	2	3	4	5
Sex activities	1	2	3	4	5
Knees	1	2	3	4	5
Posture	1	2	3	4	5
Face	1	2	3	4	5
Weight	1	2	3	4	5
Sex organs	1	2	3	4	5
Back view of head	1	2	3	4	5
Trunk	1	2	3	4	5
Buttocks	1	2	3	4	5
Thighs	1	2	3	4	5

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