LIFESTYLE ORIENTATION OF HIGH VERSUS LOW ACHIEVERS IN TRADITIONAL SCHOOL SPORTS : AN HOLISTIC ANALYSIS

BY

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THESIS

Submitted in fulfilment of the requirements for the degree

Master of Arts

Department of Human Movement Studies

Rhodes University, 1993

Grahamstown, South Africa

ABSTRACT

One hundred and four subjects aged 16 - 18 years volunteered to participate in this study which sought to identify via an holistic model those factors that characterise the lifestyle orientations of high and low achievers (male and female) in traditional school sport.

Subjects were evaluated with respect to their anthropometric, physiological, psychological and perceptual responses. The data were statistically analyzed by one way ANOVAS for significant differences in the following pairs; males and females, high and low achievers, Mhi (male high achievers) and Mlo (male low achievers), and Fhi (female high achievers) and Flo (female low achievers).

Anthropometric results indicate that Fhi and Flo were significantly different in their stature, mass and body fat, while Mhi and Mlo show no significant differences. A greater disparity existed between VO_2 max of Fhi and Flo compared with Mhi and Mlo, along with trends in heart rate and RPE responses that were also more divergent. Psychological responses indicate that Fhi and Flo were significantly different in five of the seven sub-domains of CATPA, while Mhi and Mlo were only identifiable in one. In the PSPP Fhi and Flo were significantly different in all five subscales, while Mhi and Mlo in only two.

This contrast in variability between the paired group analysis of Fhi and Flo as compared to Mhi and Mlo appears throughout the data.

ACKNOWLEDGEMENTS

In completing this study I wish to extend my sincere thanks to the following people:

Professor Pat Scott, not only for her guidance and patience, but also for her constant enthusiasm throughout my study.

Professor Jack Charteris for his input and support throughout the duration of this study.

The schools, teachers and subjects whose co-operation made this project possible.

The staff and students of the Human Movement Studies Department who assisted in the many data collection sessions.

Ros Parker, who helped in the laborious task of organising this text.

Last, but by no means least, to my mother and family who have been supportive and helpful throughout my period of study in South Africa.

TABLE OF CONTENTS

PAGE

APPENDICES **PAGE**

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

As we approach the year 2000 Man's general mode of living and working is patently different from that of his predecessors in past centuries where work was characterised by its physical nature. The technological innovations of modern Western Society have created a sedentary work environment for many people, leading to a decrease in physical involvement and a concomitant increase in psychosomatic illness. Thus in sedentary populations the importance of leisure time physical activity as a preventative measure against chronic disease (especially of the heart and the cardio-vascular system) has become well recognised (Paffenbarger *et al.*, 1990). However, according to American College of Sports Medicine (1990) the adoption of active leisure time lifestyles by adults is relatively low. The combination of sedentary work environments and sedentary leisure time lifestyles has seen an epidemic development of what Kraus and Raab (1961) termed hypokinetic diseases; simply put these are disorders resulting from a lack of physical activity. In The Health of the Nation (1991) it was reported that illnesses related to sedentary lifestyles are among the most prevalent death statistic in Western Culture. The Heart Foundation of Southern Africa (1992) identified South Africa as having one of the worst rates of chronic heart disease (CHD) in the world, where at present 28.5% of 35 - 64

year olds die from chronic diseases of lifestyle. This supports the findings of Simons (1986) in his research of estimated international coronary heart disease death rates where South African men and women rank fourth and first respectively in comparison to 14 other countries. These statistics do not take into account long term suffering of these people and the huge cost to the South African health services, which estimate that over R200 million is spent on drugs for hypertension alone.

Current research on the effects of habitual exercise on health has been extensively studied in adults, but less attention has been paid to these considerations in children (Dishman and Dunn, 1988). This appears to be a weakness of much epidemiological and related research, when one considers that chronic diseases are characterised by their long term latency, often originating in childhood. Therefore, those people who are presently suffering from CHD (and facing potential premature death), can in all probability trace the emergence and possible cause of their illness to lifestyle habits adopted in childhood (Powell and Dysinger, 1986). Montoye (1985) reiterates this point by stating that with increased understanding of atherosclerosis, the disease underlying most heart attacks, it has become clear that the heart attack is the result of a very long process. It would appear that most of the research relating to children's propensity for hypokinetic disease of which CHD is the most prevalent statistic, has focused on somatic indices such as the presence of fatty streaks in the

coronary arteries of children, which according to McGill (1980) is correlated with the incidence of raised lesions in middle age. Brooks and Fahey (1985) indicate that CHD begins in childhood and that by 20 years of age, it is estimated that 75% of males have CHD to a significant degree. However, it should be noted that indices of hypokinetic disease such as hypertension, obesity and atherosclerosis develop gradually over time, thus the identification of corporeal risk factors in children and young adults may often be unclear, because they are in their early stages. This is apparent in the findings of Kemper (1980) who reported that the blood pressure of active 13-14 year old boys was not significantly different from that of less active boys of the same age.

Although habitual physical activity is being studied in children Montoye, (1985) makes the observation that methods still leave a lot to be desired. The same author points out that this may be the result of the considerable difficulties inherent in trying to assess physical activity in children. However, recent developments in psychometric inventories analyzing physical activity have offered the researcher an effective method of evaluating an individual's predisposition towards physical activity. By utilisation of selected attitudinal and physical self-perception inventories, it is considered that they have the capacity to elicit accurate data regarding children's feelings and perceptions of physical activity, and the degree of subsequent involvement. There

appears to be little, if any research conducted in South Africa into children's personal awareness and perceptions of the benefits of regular exercise involvement. There is a need to examine these perceptual factors in association with relevant anthropometric and physiological measures that are often indicative of physical inactivity (e.g. high percentage of body fat and low aerobic status); thus providing an holistic approach, which engenders a clearer and more complete understanding of activity orientation in children. More specifically cognizance should be taken of how children perceive the demands of physical exertion, for it has been proposed that what people think they are doing may well be more important than what they are doing (Morgan, 1973; Rejeski, 1981; Borg, 1982; Rejeski, 1985).

A multi-disciplinary approach, as advocated by Charteris *et al.* (1976), is likely to produce greater insight into the question of why many children appear to lose interest in participation in physical activity, as well as the implications this physical apathy may have for the development of chronic diseases. Physical inactivity continues to be a major concern for health. Loper *et al.* (1989), in a review of studies conducted in the last 15 years show that children of elementary and secondary school age are clearly not developing a lifestyle which would lead to a low risk of chronic disease. It would appear that children are spending an increasing amount of time in sedentary pastimes, and according to Singer (1985)

television viewing (a sedentary pastime) is widespread among the general population, especially in young adults and children, and may be contributing to maladaptive health habits. This contention has been supported by the findings of Tucker (1990) who reports that the daily duration of television viewing is strongly and inversely associated with cardiovascular fitness in both adults and adolescents. This does not take into account more recent technological additions to home entertainment such as videos and computer games. According to Godin and Shephard (1983) a low level of physical activity persists in most of the North American population despite the much heralded 'fitness boom'. More recently, analysis of children's activity levels by means of continuous heart rate monitoring has further reiterated this point, with Armstrong and Bray (1991) concluding in their research that the current level and pattern of British children's physical activity throughout the academic year, including weekends is a cause for grave concern. Consequently it is necessary to examine children in the milieu in which exercise and health behaviours are initially developed, namely the school (Bar Or, 1990) and investigate the criteria by which children are being presently guided.

There is no doubt that assessment of physical performance is important and it would appear that the standards which are being used in many South African schools at present, to assess physical achievement, are determined to a large degree by the

great emphasis placed on traditional team sports and interschool competition (Van Dalen and Bennett, 1971; Leary and Thanning, 1990). Thus recognition of high achievement in the school system is customarily procured by representing the school in a traditional team sport, such as rugby or cricket for boys and hockey or tennis for girls. Such a competitive emphasis in a limited number of traditional sports lends itself to a predilection of resources being conferred on a minority of physically gifted children. This in essence can lead to the marginalisation or even possible alienation of many children, who within the confines of such a dogmatic competitive system may well perceive of themselves and their efforts with a sense of low achievement. Furthermore, Ford (1990) indicates that physical education teachers are often under considerable pressure to concentrate on elite performers who enhance the status of both teacher and school. Thus, it can be seen that a number of diverse influences during childhood may well have potent implications for the adoption of an active or indeed inactive lifestyle orientation. This point in particular illustrates the need for an rigorous holistic analysis to reveal how children of differing competitive standards perceive physical activity in school, because the experiences and perceptions of physical activity by high or low achievers may well provide key explanatory factors in the development of active lifestyle orientation.

It should be noted however, that even though the South

African Physical Education Syllabus emphasizes comprehensive participation as one of its primary goals, it would appear that in many schools the Physical Education programme is often under pressure from a number of sources, not least among them the school hierarchy, parents and community, to prioritise the success of the school teams. Noakes (1992) suggests that until sport at school is restructured to emphasize participation (as well as, and not instead of, competition for the genetically gifted) the present poor state of physical inactivity in the majority of adult South Africans will remain. This point is further emphasized by du Toit (1992) who postulates that if an active physical lifestyle were to be meaningfully developed in the young and developed throughout a natural lifespan, then at least 50% of CHD mortality in South Africa could be prevented.

STATEMENT OF THE PROBLEM

This study has as its focus the lifestyle orientation of children during crucial formative years. The contention is that lifestyle orientation can be identified by means of established psychometric tests, which evaluate attitudes and physical self-perception, relative in the present study to physical activity in general.

Using two psychometric tests the aim was to establish a "predispositional profile" of schoolchildren in order to ascertain whether those rated by teacher/coaches as "high

achievers" differ from those rated as "low achievers" in traditional school sports.

A second problem involved determining the actual physical status of the children, using established assessments of physical work capacity (PWC) in order to determine whether those rated by teacher/coaches as "high achievers" differ significantly in PWC from those rated as "low achievers". The possibility of sex-related differences was also investigated.

It was anticipated that interesting correlations may well be revealed between actual PWC, rated achievement and lifestyle orientation, as assessed by psychometric tests.

RESEARCH HYPOTHESIS

The general hypothesis of this project was that school physical activity programmes exert a substantial and lasting influence on an individual's life-time commitment to regular participation in physical activity, and as such may have lasting positive or negative affects on the general health and well-being of the individual, depending on how such programmes are perceived.

TEST HYPOTHESES

Hypothesis 1. No difference exists between males (M) and females (F) with regard to their morphological (AN), physiological (PH), and psychological (PS) responses.

Stated statistically, the null-hypothesis is:

HO: $\mu\ M_{(AN, PH, PS)} = \mu\ F_{(AN, PH, PS)}$

The alternative hypothesis is:

HA: $\mu\ M_{(AN, PH, PS)} \neq \mu\ F_{(AN, PH, PS)}$

Hypothesis 2. No difference exists between high (Hi) and low (Lo) achievers with regard to their morphological (AN), physiological (PH), and psychological (PS) responses.

Stated statistically, the null-hypothesis is:

HO: $\mu\ Hi_{(AN, PH, PS)} = \mu\ Lo_{(AN, PH, PS)}$

The alternative hypothesis is:

HA: $\mu\ Hi_{(AN, PH, PS)} \neq \mu\ Lo_{(AN, PH, PS)}$

Hypothesis 3. No difference exists between male high achievers (Mhi) and male low achievers (Mlo) with regard to their morphological (AN), physiological (PH), and psychological (PS) responses.

Stated statistically, the null-hypothesis is:

HO: $\mu\ Mhi_{(AN, PH, PS)} = \mu\ Mlo_{(AN, PH, PS)}$

The alternative hypothesis is:

HA: $\mu\ Mhi_{(AN, PH, PS)} \neq \mu\ Mlo_{(AN, PH, PS)}$

Hypothesis 4. No difference exists between female high achievers (Fhi) and female low achievers (Flo) with regard to their morphological (AN), physiological (PH), and psychological (PS) responses.

Stated statistically, the null-hypothesis is:

HO: $\mu\ Fhi_{(AN, PH, PS)} = \mu\ Flo_{(AN, PH, PS)}$

The alternative hypothesis is:

HA: $\mu\ Fhi_{(AN, PH, PS)} \neq \mu\ Flo_{(AN, PH, PS)}$

DELIMITATIONS

In this study 51 boys and 53 girls aged 16-18 years, were selected according to whether they were high or low achievers in traditional school sports. Thus, four discernable groups were studied; high and low male achievers, and high and low female achievers in traditional school sports. The children

were recruited from four schools in the Grahamstown area.

The children were subjected to the following tests;

Anthropometric: Stature and mass, waist-to-hip ratio (WHR) and skinfolds.

Physiologic: Aerobic capacity (predicted VO_2 max) and heart rate.

Psychologic: Children's Attitudes Towards Physical Activity (CATPA) and the Physical Self-Perception Profile (PSPP).

Psychophysiologic: Borg's revised effort perception scale.

Data were collected on the subjects during each of the three testing sessions. The first session was allocated to collecting base line data and the completion of the two questionnaires, CATPA and PSPP. The second session involved anthropometric measurements, and the third session was concerned with the collection of physiological data.

LIMITATIONS

The following limitations must be considered while examining the implications and subsequent conclusions drawn from these experimental results.

1. The sample used was restricted to four schools in the Grahamstown area, two of which were government schools, and the other two being private schools. It is recognised that the pupils used as subjects are of a relatively small

number (n 104) and are furthermore representative of only a small geographic area and demographic sample, with regards to South Africa as a whole.

2. Other than voluntary compliance with a request to maintain normal eating and exercise habits during the course of the study, there was no control over these external influences.

3. As subjects were not tested at the same time of day during each session, diurnal variation in exercise response may have affected the experimental results.

4. Testing sessions for the Multi-Stage Fitness Test occurred in a number of different gymnasiums with varying types of floor surface, and it is possible that minor variations in the prediction of aerobic capacity may have resulted.

CHAPTER 2

REVIEW OF LITERATURE

"MAN-IN-MOTION": CONCEPTUAL INTRODUCTION

There is little doubt that Man was designed to be active (Corbin and Lindsey, 1991). The same authors indicate that the need to be active is associated with the "fight or flight" response. In search of food, primitive Man sometimes had to fight with other predators or flee for safety. In either case, the response was often vigorous activity. Even our more recent ancestors (pre-Industrial Revolution) were often required to do vigorous activity as part of a their normal daily routine. Thus in the general population with albeit a few exceptions Man's lifestyle was characterised by a substantial amount of physical activity as a result of the demands of work or through choice in the pursuit of recreation and exercise.

The broad conceptional basis for this study concerns itself with "Man-in-motion" and this relates very much with the theoretical framework of the "Centre M" Model as proposed by Charteris *et al.* (1976) which recognises the inseparable relationship between Man and his movement, and, in an attempt to focus on "Man-in-motion" (as opposed to Man when in motion), seeks infusion from widely diverse academic fields.

The "Centre-M" has four foundational propositions, the first being that human movement must be initially comprehended in a dimension of time, the time based levels ranging from movement actually in progress through to the study of the

development of movement patterns at phylogenetic level. Foundational proposition two is concerned with the examination of the interaction between the moving organism and the environment through which it moves; while proposition three accepts that the essential humanity of the moving organism implies a psycho-social dimension of study. The fourth proposition holds that the edification of human movement is most effectively procured by multi-disciplinary approach.

The reasoning behind this conceptual model is based on the assertion by Charteris *et al.* (1976) that an holistic approach towards research of human responses is likely to produce greater insight into the problem and be more rewarding. The same authors emphasized that it becomes apparent in terms of scientific focus, that human movement is incompletely or unsatisfactorily elucidated when studied from the standpoint of only one of the biologic, physical or social sciences.

It therefore follows that the initial application of the "Centre-M" model infers an understanding of the study in a temporal framework or in some sort of historical context. In the present project an outline of the conceptual prominence that "Man-in-motion" is seen in a general temporal frame of reference will be presented and more specifically will focus on the integral importance of physical activity with lifestyle orientation. This is an interesting aspect of the study for it illustrates that throughout documented history the benefits that physical activity as part of ones lifestyle in work or in

play can bring to the individual and community. This point is summed up by the words of Aristotle, who is reported to have said that the education of the body must precede that of the mind (Rice *et al.*, 1969).

HISTORICAL CONTEXT OF PHYSICAL ACTIVITY

Gordon and Gibbons (1991) cite that it was Hippocrates, the fifth-century B.C. Greek physician, who said all parts of the body which have a function, if used in moderation and exercised in the labours in which each is accustomed, become thereby healthy, well-developed and age more slowly; but if unused and left idle they become liable to disease, defective in growth, and age quickly. This assertion that physical activity is positively linked with health and general well-being appears to be a strongly held and prevalent viewpoint since the very earliest times, including the archaeological evidence of sport and games from the Sumarian civilisation of 3,000 to 1,500 B.C. (Palmer and Howell, 1973) and up to the present day, where medical practitioners have endorsed exercise as an essential component for a healthy lifestyle orientation. The growing interest and acceptability of exercise as a medical tool becomes obvious when one observes the increasing number of exercise related citations in the annual Index Medicus, which lists all articles published in major medical journals. Between 1943 and 1953, the average yearly exercise citations was 110; this rose to 328 in 1963, 798 in 1973, and 1,278 in 1983

(Gordon and Gibbons, 1991).

Even so it is worth bearing in mind that the benefits of physical activity are not simply restricted to biological, physiological and medical factors. One of the interesting historical themes regarding physical activity is the importance accrued to it in terms of personal, social and moral development of not only the individual, but of society as a whole. This is most clearly portrayed in a historical review by Arnold (1986) who described that there was a strong belief, although not scientifically supported, of the connection between the playing of team sports and the development of social and moral values. This belief emanated from the English public schools of the 19th century which considered that physical activity particularly in the form of team games was educationally useful in that it led to desirable social and moral outcomes including such qualities as magnanimity, courage and steadfastness. It is interesting to note that although these beliefs regarding the influence and almost righteous qualities with regards to physical activity may be construed as outdated in todays modern world, it is clear that these beliefs are a common thread in the chronicles of history as a justification for its implementation right up to the present day.

Thus, the promotion of physical activity and the adoption of physical fitness appears throughout recorded history as an integral feature of many prominent civilisations and cultures.

The Ancient Greeks placed much value on sporting and physical activities which represented a dynamic and important process in their culture. This is perhaps most clearly visible in the status accorded to the Olympic Games and its participants, which was first staged in 776 BC. This societal affection for physical activity was to influence generations of Greeks, Romans, Macedonians and others who were to follow them historically (Harris, 1972).

In the Middle Ages the Teutons were to eventually acquire the more aesthetic skills for which the Romans and more particularly the Greeks were known, and the combination of physical vitality and intellectual growth created a backdrop for the development of Western Europe and ultimately the New World (LeUnes and Nation, 1990).

It was the Age of Enlightenment which provided the intellectual and philosophical impetus which has done much to shape the present understanding and implementation of physical activity. England was operating under a form of democracy, making it unique at that time. The French and the Americans in New England were becoming aware that education for all was a worthy goal, and it should be neither the responsibility of the church nor the right of the wealthy or noble. According to Gerber (1968) these changes coupled with the collective efforts of influential thinkers, from Copernicus and Rabelais to Locke and Rousseau, who viewed physical education as an essential requirement as part of the total development of the child

resulted in a veritable explosion of organised physical activity all over Europe in the eighteenth and nineteenth centuries.

Physical Activity in Modern Times

More recently, in this century, one can see the reaffirmation of physical fitness and activity as an integral element of American society by Presidential statements that are characterised by their supportive and positive nature.

Theodore Roosevelt in 1905 was reported to have said that he believed strongly in value of physical activity and saw football as the most valuable of all team sports because it provided each individual with opportunities to test his courage (Lewis, 1969).

Dwight D. Eisenhower (1890 - 1969) spent a considerable amount of time promoting public attitudes and behaviours to physical fitness and sports, culminating in the Presidents Council for Youth Fitness. This infusion of Presidential backing into the fitness realm must be regarded as a landmark event (LeUnes and Nation, 1990).

President Johnson saw physical fitness as a matter of fundamental importance to individual well-being and to the progress and security of the American nation (Chaney, 1978).

Probably the most well known address using physical fitness as its theme, was by JF.Kennedy in 1960, when he expressed that physical fitness is not only one of the most

important keys to a healthy body it is also the basis for creative and dynamic activity (Corbin and Lindsey, 1991).

Since 1960 one has seen the embodiment of physical fitness as a symbol epitomising the superiority of certain political idealogies, particularly the Communist regimes of Eastern Europe and the Soviet Union. This was manifested most clearly at the Olympic Games where physical prowess and success were deemed to demonstrate that nations physical, cultural and political ascendancy. Thus physical prowess can be seen as an essential element of societies hegenonomy (McGregor, 1989).

Historical Context of Physical Activity in South Africa

The present character of physical activity in South Africa is in many respects the result of European influences and involvement in the 19th Century and early 20th century. Also during this period many South African Physical Education teachers visited Europe and were greatly affected by their experiences there. The presence of British soldiers in South Africa fostered the promotion of sport and games amongst the settlers, which flourished in the favourable climate (Van der Merwe, 1986).

It was only in 1936 that Physical Education became a compulsory subject in all schools and even though legislation was passed in 1967 to enforce uniformity of syllabi for all subjects in the various provinces, Physical Education was excluded because it was a non-examinable subject (Van Dalen and

Bennett, 1971). This exclusion from legislated syllabi structure allowed schools to largely determine what they considered the essential requirements for physical activity in general and specifically what was included in the Physical Education programme. Van Dalen and Bennet (1971), report that inter-school competition was strongly stressed and the games programme is generally voluntary, and well supported by parents and educational authorities. The predominate sports are rugby and cricket for boys and field hockey and tennis for girls. Leary and Thanning (1990) consider that many South African schools concentrate on these 'traditional sports' almost to the exclusion of to all else. These sports in particular are often an integral part of the schools merit system. Therefore representative honours at school level, provincial and national are accorded increasing levels of prestige.

Thus it may be argued that the historical and cultural influence on school physical activity has resulted in many of the schools having a system that largely caters for the gifted individual (Noakes, 1992) in a narrow range of sports, marginalising and neglecting the needs of the majority of school children, who as a consequence of a selective and limited Physical Education system develop a predisposition toward a sedentary lifestyle in adulthood with an increased propensity for hypokinetic disease. Finally it has been reported that limiting children's experience of physical activity to only within the confines of inter school team

sports has according to Brill *et al.* (1989); Sallis *et al.* (1989) and Wilson *et al.* (1990) little if any influence with regard to individuals adopting a physically active and healthy lifestyle. In view of the reported high levels of inactivity in adult South Africans and the causally associated prevalence of cardio-vascular morbidity and mortality as reported by the Heart Foundation of Southern Africa (1992) it is reasonable to conclude that the aim of this study in terms of providing at least some explanation of the reported high levels of physical inactivity by means of an holistic model is not only necessary but very important, particularly so, in terms of the emphasis on attitudinal and perceptual parameters which appears to have had scant attention in the past.

LIFESTYLE ORIENTATION

It is apparent that sedentary (physically inactive) lifestyles are very much the legacy of the technological innovations of the 19th and 20th centuries, resulting in a mechanized and automated society. Thus if climbing a flight of stairs leads to breathlessness and palpitations of the heart, one can simply use the escalator, if walking or cycling to work means tiredness or fatigue, one can simply drive the car. This change in Man's lifestyle orientation toward physical activity is summed up by Fieldsend (1980) who indicated that unlike our ancestors, who were forced to labour to heat their homes, collect water, gather food and defend themselves, most people

today get far to little exercise; the result being that, although infectious diseases have largely been conquered, modern Man does not necessarily experience better health and, appears to be at greater risk of dying as a result of lifestyles and attitudes that admit little time for exercise.

The main focus of this study was to examine lifestyle orientation in children, with particular emphasis on their attitude and involvement in physical activity. It is stressed by Caruso and Gill (1992) that by a vigorous examination of selected evaluative components, namely attitudes and physical self-perception, one will be able to elucidate how children feel about and perceive physical activity. This is a crucial factor towards understanding whether or not an individual is predisposed towards an active lifestyle, because it is through this consanguineous process with physical activity that the individual develops a fundamental behavioural component known as self-concept. According to Coombs *et al.* (1976) self-concept is the most stable, important and characteristic self-perception of a person. Therefore in terms of identifying those individuals whose lifestyle orientation is characterised by physical activity or inactivity, the utilisation of selected psychological questionnaires offers the researcher with a most valuable method for investigation. This point is augmented if one considers that somatic indicators of sedentary lifestyle tend to be developmental; thus as people age, depending on their level of activity, a number of physical changes may

occur, including increased fatness and possibly obesity, an increase in hypertension and undesirable lipo protein cholesterol levels. While, these corporal indices are most apparent in adulthood, they are not clearly evident in children. Kemper (1980) reports in a review of blood lipid analysis studies, that there appears to be no significant difference in serum total cholesterol between active and non-active children.

The Heart Foundation of Southern Africa (1992) points out that it has become increasingly clear in more recent times that several lifestyle or individual behaviours and habits, particularly physical inactivity, are seen as major determinants of disease. This is reflected in the concerns voiced by the same authors regarding an increase in chronic diseases, which are associated with physical inactivity, especially those related to the cardio-vascular system. These authors report that cardio-vascular diseases kill more people world wide than all other diseases, including infectious diseases. The origin of these chronic diseases can be traced in all probability to lifestyle patterns developed in childhood, for as Yach (1992) points out, chronic diseases are characterised by their long term latency.

Loper *et al.* (1989) report that studies over the last 15 years show that children of elementary and secondary school age are not developing a lifestyle which would lead to a low risk of chronic disease. The presence of alterable coronary heart

disease (CHD) risk factors in the youth of the United States was clearly established in the 1970's (Wilmore and McNamara, 1974; Gilliam *et al.*, 1977). In terms of cardio-vascular morbidity and mortality, South Africa has a population prevalence which are among the highest in the world (Seftel, 1992).

The cost of these diseases is not only measured by the long term suffering of those who are ill and their diminished sense of well-being, but also in financial terms. Hoeger (1986) reports that the unhealthy lifestyle habits of Americans regarding diet, exercise, smoking, obesity and other health behaviours have contributed significantly to spiralling health care costs. The annual expenditure by Americans on drugs for hypertension alone, amounts to $8 Billion (The Joint National Committee, 1988). These are only a fraction of the costs that are spent on health care for patients suffering from cardio-vascular disease, which are particularly demanding in terms of the needs for high technology, life support systems and a heavy reliance on medical and pharmaceutical treatment.

Despite the warnings by health and medical professionals, negative health values and physically inactive lifestyles continue to be the prominent risk factors resulting in chronic diseases. du Toit (1992) points out that there is no vaccination against these diseases, only prevention through diet, controlling blood cholesterol, regular exercise and avoiding the use of tobacco.

Lifestyle Orientation and Childhood

As previously mentioned chronic diseases of lifestyle are likely to originate from health and activity behaviours adopted in childhood. In view of the epidemic proportions of hypokinetic disease as reported by Corbin and Lindsey (1991) and the Heart Foundation of Southern Africa (1992) and related cardio-vascular morbidity and mortality, as well as, the immense burden it places upon the health system, it brings the question of what steps can be taken to solve this problem.

In some respects the answer is simple, but unfortunately its implementation would appear to be fraught with difficulty. In the first instance, it is well known and cited that hypokinetic disease is largely avoidable if one adopts a healthy, active lifestyle orientation (The Health of the Nation, 1991; Heart Foundation of Southern African, 1992). However, particularly in the case of South Africa, a nationwide, structured and well researched health and fitness programme aimed at increasing regular physical activity throughout the populace, has as yet, to be fully implemented.

Bar Or (1990) considers that for any beneficial long term effects that they might impart to society, enhanced physical activity and subsequent improved general fitness should be promoted in as large a segment of the population as possible. It is unlikely that such widespread enhancement will be achieved through sports clubs, recreation centres or individual home programmes (which appear to be the hope of South African

legislative policy, since the recent retardation of the school's physical education programme).

On the other hand, Bar Or (1990), considers that the school has much potential as an environment in which exercise and general physical fitness can be promoted for itself or as part of a more comprehensive health education programme.

In a recent review of 13 published programmes that had been held in the United States and Canada, the general conclusion drawn was that such health and fitness programmes did induce either weight loss or reduction in body fat. Those programmes that were successful in inducing reduction of adiposity had the following denominations (Ward and Bar Or, 1986):

- A multidisciplinary intervention that included enhanced activity, nutrition education and behaviour modification.
- Exercise classes 3-5 times per week that promoted and provided incentives for afternoon activities.
- A team approach that combined input from the nurse, guidance councillor, lunchroom supervisor, and physical education teacher.
- Coordinated parental involvement to support new behaviours.

Austin and Nowak (1987), indicated that physicians, dentists, drug counsellors and directors of health agencies believed that physical education could have a productive impact

on health. Loper *et al.* (1989) continue in the same vein, and state that in ranking a variety of secondary physical education topics, these health care professionals indicated a unanimous choice of "physical fitness" as being the most important in the physical education curriculum. In a survey conducted by the Nebraska State Department on 900 adults regarding physical education, they concluded that programmes should concentrate on teaching activities designed to improve overall health and fitness (Patrakis *et al.*, 1985). South African schools have traditionally placed great emphasis on team sports and inter-school competition as part of its physical education policy (Van Dalen and Bennett, 1971). Bearing in mind the studies conducted in North America and the conclusions drawn, is it possible that the nature of physical education in South Africa is in some way linked to sedentary lifestyles, which predominate in the adult population and the related high incidence of hypokinetic disease.

Based on the evidence and experience of North American studies investigating sedentary lifestyles, it would appear prudent for South African Education and Health agencies to develop and coordinate programmes which have the potential to instil positive lifestyle behaviours in South African children. This will obviously mean a considerable change in the content and aims of present school syllabi, but as Loper *et al.* (1989) point out, physical education teachers should be able to evaluate health behaviours and prescribe appropriate

modifications which would lead to a healthy lifestyle. The same authors also indicate that it is more important for physical education teachers to be able to produce health outcomes than to be able to coach one or more sports.

Even so, it should be borne in mind that there appears to be no empirical longitudinal studies that have examined physical activity through childhood, adolescence and adulthood, and its relationship with hypokinetic disease and particularly CHD. The result being that most research pertaining to the role of physical activity in good health and the adoption of positive lifestyle habits have to date been based on largely short term experimental studies. Malina (1990) states that physical activity is often viewed as having a favourable influence on growth maturation, body composition and physiological fitness. However the same author points out that the role of physical activity and physical fitness during childhood as a favourable influence on the health status of adults or as a preventative factor in disease of adulthood is not yet established.

It is obvious however, that such longitudinal studies would take a considerable period of time to complete. It is the opinion of Bar Or (1990), that society should not and cannot afford to wait for the definitive evidence, and should therefore promote activity and fitness in youth while supporting research on specific health related issues. This is analogous to society's commitment to curb smoking long

before definitive evidence had been provided about its detrimental effects on health.

HYPOKINETIC DISEASE

The term 'hypokinetic' is derived from "hypo" meaning under or to little, and "kinetic" meaning energy or activity. Thus hypokinetic means to little activity, and was first coined as a term by Kraus and Raab (1961). Hypokinetic disease is associated with a lack of physical activity or too little regular exercise.

One of the ways that exercise and physical activity contribute to optimal health is by helping reduce the risk of hypokinetic disease and related conditions. Corbin and Lindsey (1991) report that given the epidemic proportions of heart disease, the prevalence of back pain as a major adult complaint, the high incidence of fatness and obesity among children as well as adults, the dangers associated with the widespread existence of high blood pressure, ulcers, and mental health disorders, the reduction of hypokinetic disease is a priority health concern for Western culture.

The importance of physical activity and regular exercise are considered key components for the alleviation of risk factors associated with the development of hypokinetic disease. This has been congruent with the findings of epidemiological research, where Paffenbarger (1988) points to the independent nature of physical activity in the cause and effect

relationship of hypokinesis in the presence and absence of other influences. This is clearly demonstrated in a report from the Heart Foundation of Southern Africa (1992) which illustrates the strong independent nature of physical activity, where meat porters, working in Smithfields Market, London were compared with another group of office workers who worked in the City of London. Although the levels of smoking were similar for the two groups, the meat porters actually had lower carbon monoxide levels than office workers. It was concluded that the porters through the physically active nature of their work, were hyper-ventilating and excreting more carbon monoxide. The same authors report that carbon monoxide is a contributory factor to myocardial ischaemia and therefore heart disease. In another example, Morris (1990) in the United Kingdom, found that among 9000 male civil servants, the rates of CHD over a nine year period were significantly lower for those taking vigorous physical aerobic exercise than for others in the study. This is consistent with other longitudinal studies including that of 6,351 San Francisco, long-shoremen over a twenty two year period from 1957 - 1972. It was found that cargo workers who did work of a very physical nature (requiring 8,500 K.cal a week), to have much lower risks of fatal CHD than did men who held less physically demanding jobs such as tally clerks, hoist operators and foremen (Paffenbarger *et al.*, 1980). Intrinsic to the benefits of physical activity are improved aerobic fitness and health, and the inference of

potentially increased longevity. Paffenbarger (1988) in a hypothetical representation of the epidemiological follow-up study of Harvard alumni, converted actuarial life tables to predict life outcome or extension and it is interesting to note, that if one were to equate a linear regression of these figures, a 16-year old participating in regular aerobic activity throughout his/hers lifespan could extend his/hers life by approximately 4.0 years beyond a projected 80-year expectancy. Similar findings have been presented by Weinhaus (1969) who postulated that life expectancy is decreased 1 year for each 5lb above ideal body weight.

In summary, there is a substantial amount of research in the related literature which indicates conclusively that physical activity, whether it be a feature of work and/or an extra curricular lifestyle, is an independent factor inversely related to the incidence of hypokinetic disease particularly CHD. Furthermore, Rowland (1990) reporting on strategies for the prevention of CHD, states that recent studies have convincingly indicated a strong link between physical activity and decreased cardio-vascular morbidity and mortality. These have provided a new impetus for the promotion of regular exercise habits established in childhood and maintained throughout life. Other benefits include improved quality of lifestyle and of health, and if not necessarily a guarantee for a longer life, will certainly enhance one's general well-being throughout one's lifespan.

PHYSICAL ACTIVITY

Appropriate physical activity or exercise, like food and sleep, is a necessity for healthy living. It also helps to prevent heart attack, maintain a healthy weight, to strengthen bones, and to preserve independence in the elderly and people with a disability (The Health of the Nation, 1991). The same document reiterates the importance of this topic, by stating that one of its policy objectives is "to improve the health and well-being of the nation through appropriate physical activity"(p.71). The understanding that physical activity has an important role to play in the promotion and adoption of active lifestyles was recognised by the physical education profession in Britain, and resulted in Health Related Fitness (HRF) becoming an essential aspect of the curriculum. Almond (1983) pointed out that there are indications that the physical education profession could play an important role in raising public consciousness about the value of exercise, being physically active as a part of one's lifestyle, and providing access to ways in which people can look after themselves. However, there appears to be a lack of understanding regarding what is meant by physical activity in terms of how much, when and what to do, and the associated health benefits. According to Tinning (1991) this may be due to the fact that during formative childhood years, school programmes (physical education and related health studies) actively problematises health by reproducing notions of a healthy lifestyle which are

ill-conceived, and lacking in contextual reality.

Therefore, according to Tinning (1991) physical activity is a concept which must be developed in an educational framework with an understanding of the associated health benefits, simply setting children off on a regular run is not sufficient. Bouchard *et al.* (1990) define physical activity as a broad term which if taken literally, may describe practically any form of human or bodily movement produced by skeletal muscles, resulting in energy expenditure. This is a particularly capacious definition, therefore it is reasoned that a slightly more refined interpretation of the term as provided by the ACSM (1990) provides a more relevant and structured definition for the purposes of this study. Thus physical activity can be envisaged to be characterised by walking, hiking, jogging, dancing, running, swimming, cycling, game activities, rhythmic human movement and/or other similar exertional actions of an aerobic nature that are evident in work, recreational and sporting situations.

However, such activities are rarely descriptive of work demands found in developed industrial nations. Montoye (1985) reports that there is convincing evidence that a sedentary lifestyle in some people contributes to obesity, coronary heart disease (CHD), osteoporosis, and perhaps some other medical problems. There are many references to an apparent negative relationship between physical activity and the incidence of cardio-vascular disease (Brunner *et al.*, 1977; Paffenbarger

and Hale 1977; Paffenbarger *et al.*, 1978).

The prominence of physically inactive or physically undemanding jobs in developed nations has resulted in a number of authors indicating that maintenance of good health can only be achieved by physical activity in ones free or non-work allocated time (Chave *et al.*, 1978; Morris *et al.*, 1980; Durnin, 1990)

Therefore if one wishes to evaluate an individual's pattern of physical activity, then a comprehensive description of it is required over a defined period of time, concerning the type, frequency, duration and intensity of physical activity. If one surmises from cited studies that the vast majority of people have a lifestyle pattern which is characterised by a physically inactive working day, then the utilisation of ones leisure time for physical activity takes on considerable importance in terms of health concerns. The ACSM (1990) make the following recommendations for (especially those individuals in sedentary work situations) the quantity and quality of training for developing and maintaining cardio-respiratory status/fitness, body composition, and muscular strength and endurance in the healthy adult. This entails being physically active 3-5 days a week, training at an intensity of 60-90% of maximum heart rate, and participating in 20-60 minutes of continuous aerobic activity.

"PHYSICAL FITNESS"

It is apparent in the reviewed literature that the terms physical activity, physical fitness, exercise and training are often used interchangeably and are as a consequence subject to a degree of tautological understanding. Lamb (1984) described physical fitness as the capacity to meet successfully the present and potential challenges in life. Physical fitness is usually more defined in its specificity of an individual's ability to perform physical tasks, and is therefore descriptive of that person's physical level or status when referenced with a challenge of a physical nature. Thus an individual achieves a level of physical fitness through involvement in physical activity or lack of it, and in this sense the terms are very much interrelated.

Corbin and Lindsey (1991) consider physical fitness to be the active human organisms ability to function efficiently and effectively. They report that physical fitness is made up of at least eleven different components each of which contributes to total quality of life. Yet it becomes apparent that it is difficult to disassociate the terms physical fitness from health, which again is a term which eludes precise definition.

However, common to the defining of both is the concept of 'optimal' quality or a state of 'wellness' (Bouchard *et al.*, 1990). Furthermore, epidemiological investigations have consistently provided support for the relationship between physical activity and physical health (Thomas, 1979). This

broad-based understanding may be described as 'total fitness', incorporating many components which many authors have emphasized, including aspects of emotional, mental and social and physical fitness (Chaney, 1978; Holmes and Roth, 1984; Brooke and Long, 1987). A further health dimension is indubitable from the findings of White *et al.* (1990) who provide systematic evidence of a relationship between exercise improved fitness and enhanced sexuality. This is likely to be perceived as a beneficial outcome along with physiological and psychological factors for those people who wish to change a sedentary lifestyle in an effort to reduce cardio-vascular disease.

This multi-dimensional understanding of physical activity and physical fitness and the implications of these factors for health considerations (particularly CHD) is congruent with the holistic approach advocated in this study.

Dishman and Dunn (1988) observe that little is known about the determinants and health outcomes of physical activity patterns among school-aged children. Many "common sense" assumptions have been made regarding the supposedly high physical activity levels of children, but recent studies examining this very point have cited that children are generally not as active as was originally thought and many children would be better described as being sedentary (Spurr and Reina, 1990; Armstrong and Bray, 1991). According to Dishman and Dunn (1988) physical inactivity is a primary risk

factor (along with obesity and hypertension) for coronary artery disease (CAD) and CHD, and is well established and alarmingly high in children. The problem is further exacerbated when one considers that inactivity becomes more pronounced as one ages (Godin and Shephard, 1986).

It becomes clear that there is a need to understand why children appear to be largely physically inactive by examining their perceptions and attitudes of physical activity and determining if these psychological traits are associated with anthropometric and physiological indices that characterise sedentary lifestyle, as well as observing how high and low physical achievers in schools relate too, or influence these relationships.

INTRODUCTION TO BODY COMPOSITION

Body composition refers to the relative percentage of muscle, fat, bone and other tissue of which the human body is comprised. It is evident from a number of studies that lifestyle orientation, in terms of whether one is physically active or not, may well have important implications for body composition. Furthermore, it is clear that the influence of lifestyle orientation on body composition, becomes more pronounced as one ages. However, it is worth bearing in mind that the adoption of negative health behaviours, which include physical inactivity are established during childhood. It is surmised by Lapidus *et al.* (1984), Larson *et al.* (1984),

Donohue *et al.* (1987), Gordon and Gibbons, (1991) that lifestyle orientation is likely to have a substantial influence on the percentage of body fat and its distribution, which are considered to be key factors for the prediction of increased propensity for hypokinesis, and related cardio-vascular diseases.

Corbin and Lindsey (1991) deem that for good health an individual should not allow body fat levels to drop too low or to become too high. There is a desirable range of 'fatness' for good health. However, an understanding of optimal percentage body fat does not seem apparent, when one observes the general population. The same authors report that in America that between 50% and 59% of the population are too fat, illustrating that a large proportion of people appear to live a sedentary lifestyle, and not to have an accurate comprehension of desirable body fat levels and the associated health concerns that are related to body composition imbalance.

Assessment of Body Composition

Body composition has become a major field of interest for many sport and exercise scientists as well as clinicians who specialize in the prevention of, and rehabilitation from hypokinetic disease. Most body composition methods are based upon the model in which the body consist of two chemically distinct compartments, fat and fat-free. The chemical

composition of the fat-free body is assumed to be relatively constant with a density of 1.1 $g.cc^{-1}$ at 37°C, a water content of 72-75% and a potassium content of 60-70 $mmol.kg^{-1}$ in men and 50-60 $mmol.kg^{-1}$ in women. Fat, or stored triglyceride, which is anhydrous and potassium free, has a density of 0.900 $g.cc^{-1}$ at 37°C (Lukaski, 1987). There are a variety of techniques which may be employed to determine body composition, but for the purposes of this study a brief review will focus largely on established methods, and those which are particularly practical for use in field settings.

Skinfold Measurements

About half of body fat is situated around the various organs and muscles of the body. The other half is located just under the skin (subcutaneous fat), or in skinfolds. Thereby, obtaining skinfold measurements at specific sites on the body and utilising the relevant anthropometric equations one can obtain a good estimate of total body fatness (Mukherjee and Roche, 1984; Brodie, 1988). These have been validated against criterion methods, such as hydrostatic weighing or whole body potassium (Brodie, 1988). Many of the formulae that have been produced are specific to a particular sample of the population, dependent on age, sex and even specialist activities. It should be noted that the more skinfold sites measured correspond with a more accurate estimate of body fat levels (Corbin and Lindsey, 1991).

Skinfold measurements and population type specific formula therefore provide effective low cost assessment of body composition (by a trained person), particularly in field situations with relatively large numbers of people, and as a consequence is considered a valuable anthropometric method especially in epidemiological studies (Brodie, 1988).

Topography of Body Fat

Topographic analysis of the overall pattern of distribution of sub-cutaneous fat, is more concerned with the overall distribution of sub-cutaneous fat at various sites of the body by measurement of girth or circumference at these locations, and its relationship with CHD, the most prevalent morbidity and mortality statistic of hypokinesis. Van Itallie (1988) describes the waist to hip circumference ratio (WHR) as the best available index for determining risk and disease. This method is based on the principle that the increased deposition of fatty tissue on the trunk is associated with an increased risk of developing CHD and attendant risk factors such as diabetes mellitus (non-insulin dependence), high blood pressure and atherosclerosis.

This predominance of sub-cutaneous fat tissue developing on the trunk, nape, neck, cheeks, shoulders and upper half of the abdomen in particular, is largely characterised in men, although not exclusively and is known as android obesity. The high incidence of CHD in men characterised by android obesity

is a well established epidemiological relationship (Raison *et al.*, 1992). Women however are characterised by sub-cutaneous fat which is most noticeably deposited in the lower half of the body (hips, buttocks and thighs). The risk of morbidity from what is termed 'gynoid' obesity is considerably different from that of android obesity. Women who are classified as gynoid obese (again some men may develop this condition) may develop biomechanical and psychological problems, but do not appear to suffer from metabolic complications (Van Itallie, 1988). The relative morbidity and mortality rates of android versus gynoid obesity and the link with males and females respectively may provide some explanation of the primary causal associations, which result in men being far more susceptible to and having a far higher rate of CHD, as compared to women. Donohue *et al.* (1987) emphasize the increased risk of CHD in men who are characterised by central (android) obesity.

The findings of Zwiauer *et al.* (1992) which is more adjacent to the present study conclude that cardio-vascular risk factors in obese children are related to obesity and body fat distribution using Waist-to-Hip Ratio. Obese children with predominantly abdominal (android) fat mass show a risk profile that is less favourable than gluteal-femoral (gynoid) fat distribution. Evaluation of body fat distribution in obese children, therefore may help to identify persons most susceptible to cardio-vascular risk in adulthood. Gordon and Gibbons (1991) report that individuals who have a Waist-to-Hip

Ratio which is excessive in android fat deposition are twice as likely to suffer from heart attacks. Reeder *et al.* (1992) as part of the Canadian Heart Health Survey Research investigated obesity and its relationship to risk of cardio-vascular disease, and conclude that obesity remains common among Canadian adults. They go on to say that there is a need for broad based programmes that facilitate positive lifestyle orientations, which include healthy eating and activity patterns for all age groups.

Body Composition and Health in Children

The health risks associated with an undesirable body composition particularly obesity increase with age (Rowland, 1990). The medical risks to children characterised by over fatness and obesity can in the terms of this study be defined by the extent to which children can be expected to carry their obesity (a symptom of physical inactivity) into adulthood. Rowland (1990) considers that in general, the older the individual, and probably the greater obesity, the more likely that obesity will persist.

There is a school of thought which postulates that every individual is born with a set body weight, advocates of this idea have given it the term 'set point theory' (Kemnitz, 1985). Supporters of this viewpoint believe that it is difficult for people to deviate from their 'set point' weight, as it is predetermined by heredity. Thus children born of obese

parents are likely to inherit the genes which will predispose them to obesity and attendant risk factors for health. Set point theory has a popular appeal for it offers a simple explanation of the occurrence of obesity, although whether obesity is passed on biologically or through social and cultural expectations (or a combination of both) is a difficult issue to resolve. Keesey (1988) considers that to determine the validity of set point theory, future studies will need to be more methodologically vigilant. In particular, more attention will need to be given to delineating functionally distinct types of obesity. The accomplishment of this will require larger sample sizes than are traditionally used.

Even so, many experts agree that there is such a thing as familial predisposition to obesity (Bouchard *et al.*, 1990). Thus children born into families with a history of obesity are more predisposed to obesity themselves. This in no small way, may be the result of children adopting unhealthy parental lifestyle behaviours, primarily characterised by physical inactivity. However, children who are obese with or without familial predisposition are not in a immutable position. A number of studies report that weight reduction programmes including diet and exercise can be effective in the control of genetically predisposed individuals to fatness, however they do require a substantial change in lifestyle orientation (Belko *et al.*, 1987).

This study is concerned with constructing an holistic

model that has the means to identify and evaluate specific indices that characterise physically active or inactive lifestyle orientations in high and low achieving children. To what degree does the influence of a traditional school sports programme have upon the morphological, physiological and psychological make up of high and low achievers, and furthermore what is the extent to which children and adolescents are likely to sustain their lifestyle orientation into adulthood with attendant risk factors for health. Corbin and Lindsey (1991) report that in America as many as 25% of school children are over-fat. Of these children 4 out of 5 will become over-fat adults, and 28 of 29 teenagers will become over-fat adults. This is in agreement with the findings of Abraham and Nordsieck (1960) and Lloyd *et al.* (1961) who reported that up to 80% of adolescents in their early teens will sustain their obesity in the young and middle-aged adult, and that adolescent obesity predisposes the individual to adiposity in adulthood. In fact it would appear that the only equivocal data in this area relate to birthweight and later obesity (Heald, 1972). There is evidence that childhood over-fatness results in hyperplasia, or an increased number of fat cells. People who have these extra fat cells are thought to have a greater tendency to become over-fat (Despres *et al.*, 1984). Finally the effect of hyperplasia in childhood and hypertrophy (an increase in the size of fat cells) in adults, along with other factors associated with chronic disease of

lifestyle, illustrates the need to understand more clearly the nature of these problems and to evaluate if they are associated with a sedentary lifestyle and negative psychological beliefs about physical activity.

INTRODUCTION TO AEROBIC CAPACITY

The assessment of aerobic capacity is widespread and according to Noakes (1988), probably the most commonly used procedure in exercise physiology is the assessment for maximum oxygen consumption (VO_2 max). VO_2 max has particular relevance to this study for it is often used in schools as a method of assessing aerobic fitness, and therefore has implications for the process of selection in traditional sports. Although it should be borne in mind that other physiological factors such as strength, speed and agility, along with certain desirable morphological and psychological traits will play a part in team selection. However the assessment of aerobic capacity in the present study was deemed to be the best criterion for indicating what Corbin and Lindsey (1991) describe as the most important aspect of general fitness.

The assessment of VO_2 max has been an avenue of interest for many years and Noakes (1988) reports in his historical review of assessment for maximum oxygen consumption, that Lindhord (1915, Copenhagen) and Liljestrand (1920, Stockholm) were possibly the first scientists to measure oxygen consumption during exercise in athletes. Since these early

studies, subsequent technological advances have enabled scientists and physiologists to assess more detailed aspects of pulmonary function in their subjects, as well as being able to administer other related assessments in tandem; such as Ph values of blood and production of lactate (Cumming *et al.*, 1972) and analysis of glycogen depletion in muscle tissue during aerobic exercise (Vollestad and Blom, 1985).

It should be noted that measurement of aerobic capacity is but one feature (albeit an important one) of human performance. In his conclusion Noakes (1988) considers the belief that oxygen delivery alone limits maximal exercise performance, has "straight-jacketed" exercise physiology for the past 30 years. Thus, performance, particularly during prolonged maximal exercise, has often been explained exclusively in terms of oxygen transport and oxygen and fuel utilization, while other factors determining, muscle contractile function have largely been ignored. Noakes is therefore critical of this preoccupation with VO_2 max at the expense of other factors within the discipline of exercise physiology. However in the broader context this singular focus, not only with VO_2 max but with physiology itself, ignores the benefits that other disciplines may provide a fuller explanation of variation in individual and group performance as induced by assessments of aerobic capacity. This point serves to reinforce the argument for a multi-disciplinary approach when researching human performance.

Assessment of VO_2 max

Direct measurement of VO_2 max on a treadmill or ergometer, using a mouthpiece to directly measure inspired and expired gasses is considered the most accurate method of assessment. A variety of protocols exist that increase metabolic rate by changes in speed, degree of gradient and resistance. In a review of treadmill protocols by Davies *et al.* (1983) and of cycle ergonometry by Beasley *et al.* (1989), both authors report that there is no significant difference in oxygen uptake between protocols.

VO_2 max is routinely assessed in exercise laboratories and although equipment can be costly, the interfacing of computers with treadmills and ergometers has made the procedure relatively straight forward. Boutcher (1990) states that directly measured VO_2 max is a reliable and valid measure of aerobic capacity and is considered by many exercise physiologists to be the gold standard of aerobic fitness assessment.

However, such methods are invariably bound to a laboratory setting and only a limited number of subjects can be tested at any one time. As a consequence of the logistical limitations of direct measurement, particularly in field situations, when assessment of large numbers of subjects is required, various alternative modalities have evolved that seek to predict VO_2 max. Perhaps the most well known and most used is the Cooper 12-minute run (1982). The rationale for this test is that the

distance an individual can walk/run in the 12-minute period is determined by his/her maximum aerobic capacity. This is similar to the 1 mile American Alliance for Health, Physical Education and Recreation test, AAHPER (1980) except time becomes the variable determinant. Obviously variations of these theories have been used, but they still operate from the basic principles that the amount of distance covered in a time period or the amount of time it takes to complete a set distance are considered to be indicators of aerobic capacity.

A different method to assess aerobic capacity is the idea that levels of physical fitness and pulse recovery after exercise are linked. Brouha (1943) developed the Harvard Step test on this principle. Thus the better aerobic capacity of the individual then a quicker return to pre-exercise heart rate levels is attained than compared to those individuals of lower aerobic status.

However, Boutcher (1990) states that for a reasonable correlation to exist between one of the above predicted tests of VO_2 max and direct tests of VO_2 max, its relevance will depend on a number of factors which include the willingness of the subject to undertake all out running, his/her experience of running technique (or stepping, or cycling) and knowledge of appropriate pace, the consistency of the track and environmental conditions, and the inter-subject variance of maximum oxygen uptake.

Multi-Stage Fitness Test (MST)

Even so, new ideas and methods continue to be developed to better satisfy the demands and needs of research. The recent emergence of the Multi-Stage Fitness Test (MST) (Leger *et al.*, 1988) as a method for predicting maximum aerobic uptake holds considerable promise, because it is less susceptible to variation and inconsistency as compared with other field tests of predicted VO_2 max (Boreham *et al.*, 1990).

The principle of the assessment is straight forward: the person being assessed runs to and fro along a measured track (20 metres) keeping up with a series of timed bleeps on an audio/music cassette player. The timing of the bleeps start off relatively slowly, but becomes progressively faster so that it becomes more difficult to maintain the required pace. The runner stops when he/she can no longer keep going at the pace set by the cassette. The stage in the assessment when the subject stops provides a good indication of that person's individual aerobic capacity. Significant correlations between the MST and direct testing methods of VO_2 max have been consistently found, particularly in children, adolescents, young people and those individuals who are able to perform a progressive and maximal exercise effort, thus making it a most attractive method for assessment in the present study. Boreham *et al.* (1990) found a correlation of 0.88 and 0.9 for adolescent boys and girls respectively with a direct VO_2 max test. Ramsbottom *et al.* (1988) found a correlation of 0.96 with

the 5 km run. Leger *et al.* (1988) similarly reported an association of 0.95 with VO_2 measured at termination of MST and Paliczka *et al.* (1987) also reported a relationship of 0.95 with a 10 km run.

Aerobic Capacity and Health

The principal limiting factor for most types of exercise that last longer than three or four minutes is the capacity of the heart, lungs and circulation to deliver oxygen to the working muscles (Lamb, 1984).

This is known as aerobic or cardio-vascular fitness and is frequently considered the most important aspect of the more general physical fitness, because those who possess it have a decreased risk of hypokinetic illness including CHD. Cardio-vascular fitness is also important to the effective performance of virtually all types of work or play activities (Powell, 1988). It is important to note that the achievement and maintenance of desirable aerobic fitness is most successfully attained by an active lifestyle orientation. There is considerable and comprehensive support throughout the related literature of the inverse relationship that exists between higher levels of cardio-vascular fitness and hypokinetic disease particularly CHD (Hurley *et al.*, 1988; Paffenbarger, 1988; Goldberg, 1989; ACSM, 1990; Kohl *et al.*, 1990).

However it should be noted that an individual's VO_2 max is to some degree genetically predetermined (Bouchard *et al.*, 1990).

Thus an individual in school who has a genetically relatively high VO_2 max, and who has to take part in mandatory sports and exercise sessions may well appear to have a desirable aerobic capacity, and therefore at a reduced health risk. Yet it should be remembered that if this person has a negative attitude towards physical activity, he/she may well be disinclined to exercise once he/she is out of the school system, lose their level of general fitness, and become more prone to hypokinesis. This premise has been supported in a number of longitudinal studies examining the type of physical activity programme experienced at school and its implication for exercise adherence in adulthood. The following authors Brill *et al.* (1989) and Sallis *et al.* (1989) indicate that where a competitive and coercive school sports programme exists, no difference between high and low achievers (when at school) was observed with regard to their exercise adherence in adulthood and propensity for hypokinesis. This implies that traditional school sports programmes which emphasize competition do little to instill positive lifestyle orientations, whether the individual was a high or low achiever on the sports field.

A major factor in the development of CHD and cardio-vascular disease is atherosclerosis, that is, the build-up of fatty deposits (plaques) on the inner walls of the coronary or other arteries, resulting in obstruction of normal blood flow (Gordon and Gibbons, 1991). The development of atherosclerotic plaques progress on coronary vessels with

age, covering the intimal surface of blood vessels at an average rate of 0.86% per year; if this rate proceeded unabated, by the seventh decade of life more than 60% of the surface of coronary vessels would be covered by atherosclerotic plaque and the lumen narrowed (Goldberg, 1989). However, some caution should be exercised if one assumes that there is a causal link between the progress of atherosclerotic plaque and its retardation by improved cardio-vascular fitness. This is because most animal, clinical and pathological studies have not shown exercise to be directly related to the atherosclerotic process, it is, according to Froelicher (1990), reasonable to conclude that physical activity does not have a direct effect on atherosclerosis. Rather the effects of regular exercise enable the body to better tolerate ischemia and to lessen the manifestation of coronary heart disease. In addition it may possibly alter other factors for atherosclerosis.

The potential beneficial actions of regular exercise are multi-factorial, thus making physical inactivity (sedentary lifestyle orientation) a complex risk factor to assess. Although there is no evidence directly linking better cardio-vascular fitness with a slowing of atherosclerotic plaque deposits, Goldberg (1989) states that physical conditioning has a substantial effect on numerous risk factors for atherosclerosis. Several independent, and in many cases inter-related risk factors for cardio-vascular, metabolic, psychologic and haematological dysfunction are modified favourably by regular physical

exercise.

A physically active lifestyle can have a pronounced effect upon the metabolism, improve fuel homeostasis by increasing glycogen storage, and improve fatty acid oxidation. Also there can be an increase of insulin sensitivity, triglyceride clearance and high density lipoprotein (HDC) formation, thereby improving glucose and lipoprotein lipid metabolism (Heath *et al.*, 1983; Holloszy *et al.*, 1986; King *et al.*, 1988).

According to DeMaria *et al.* (1978) regular physical aerobic activity improves cardiac efficiency by increasing stroke volume and reducing heart rate and blood pressure at rest and during sub-maximal exercise. Studies supporting this contention in three different age categories include Adams *et al.* (1981) who studied the effects of an aerobic training programme on the hearts of healthy college-aged men; Parrault *et al.* (1978) who investigated middle-aged men after five months of aerobic training, and Stein *et al.* (1978) working with students during a fourteen-week training programme. This point illustrates that the physiological benefits of regular exercise are possible in a range of ages, but it should be remembered that the most desirable outcomes are related to active lifestyles adopted in childhood and positively continued in adulthood.

There is considerable support in the literature which indicate the beneficial adaptations that regular aerobic exercise as part of an active lifestyle can have upon those processes which are closely associated with and linked to

hypokinesis and CHD. Furthermore, such adaptations may prevent or delay the manifestation of atherosclerotic heart disease (Bouchard *et al.*, 1990).

Powell *et al.* (1987) in a recent review of literature, examined forty-three studies of physical activity in relation to CHD, primarily among North American and European working aged men. It is of interest that not one report indicated positive association of exercise level and CHD incidence. Powell (1987) concluded that the inverse association between physical activity and incidence of CHD is consistently observed, especially in the better designed studies; this association is appropriately sequenced, biologically graded, plausible, and coherent with existing knowledge. Therefore, the observations reported in the literature support the inference that physical activity is inversely causally related to the incidence of CHD. Even so, it should be noted that there is a comparative absence of studies examining these relationships with women, children/youth, ethnic and racial groups which are non-white, and the disabled, hence the focus of this present study, specifically directed toward the youth.

INTRODUCTION TO PSYCHOLOGICAL VARIABLES

According to LeUnes and Nation (1990) psychology is one of the youngest of all the sciences, which began in 1879. Atkinson *et al.* (1983) define psychology as the scientific study of behaviour and mental processes. They point out that their definition recognises the significance of objectively studying behaviour, yet it allows for the importance of mental processes that are more inferred than observed. Also it is clear that with the recent advances in methodological techniques, especially the development of multi-dimensional psychometric analysis, that the discipline of psychology has much to offer on the present focus of this study, namely lifestyle orientation. Two areas of investigation offer the researcher valuable insight into why children appear to be either physically active or inactive, and these are attitudes and self-concept.

Attitudes

Since its introduction over a century ago, the concept of attitudes has been a focal point of enquiry in social psychology. Concern for the study of attitudes has also been apparent in the emerging field of sport psychology (Schutz *et al.*, 1981). This is reflected by the design and construction of instruments to assess attitudes toward a variety of attitude objects, including sportsmanship, intense competition, and physical fitness and exercise (Albinson, 1975).

Clearly people are not born with attitudes as such, but develop many different attitudes as they go through life (Sperling and Martin, 1992). During infancy and childhood one can see attitudes being developed through relationships with parents and other members of the immediate family. As the individual progresses through childhood the influence of the school environment will grow in importance, as will friends, peers and the wider but no less tangible effects of macrosphere factors such as the mass media (McGregor, 1989).

If a child develops and displays attitudes which are favoured by parents and school, then they are likely to be reinforced and approved. Establishment of the attitude therefore takes place. Thus the adoption of attitudes is often linked with the need to conform or be accepted by the people and community one interacts with (Sonstroem, 1974).

Attitudes are also formed as a result of a direct experience with an object or social construct (Sperling and Martin, 1992). An individual may understand that physical activity is generally good for him/her, although his/her experience of physical activity may be unpleasant. This may not be surprising if one considers the competitive nature particularly of formal physical activities at school, whereas the elite and physically gifted (a minority) tend to dominate and win, and therefore gain positive feedback, while the less able (the majority) are often marginalised, tend to lose, and often experience a more averse ordeal (Orlick, 1974; Greer and

Stewart, 1989).

Therefore, the adoption during childhood of positive attitudes towards physical activity (along with suggested changes in the South African Physical Education Syllabus which include a greater emphasis and integration of health related topics), may facilitate the development of an active lifestyle orientation. Godin and Shephard (1986) support the wisdom of promoting early life experience of physical activity, since attitudes and current exercise habits interact with prior experience in determining exercise intentions.

Attitudinal Inventory Models

Results from various studies examining the relationship between attitudes and physical activity have tended to be equivocal. This may be partially due to the fact that attitudinal inventories vary in their format, flexibility and specificity to the subject of physical activity. Researchers can utilise one of a number of scaling measures, including Thurstone scaling (1928), Likert scales (1932) and Semantic Differential scales (Osgood *et al.*, 1957). Also studies of attitudes and physical activity have largely focused on adherence and non-adherence in usually short term or cross sectional studies.

Godin and Shephard (1986) reported that personal attributes, particularly attitude and exercise habits, contribute significantly to the prediction of exercise

intentions, as did the interaction between prior experience and current exercise habits. The same authors in their study of grade 7 to 9 students, average age 13 years concluded that high intenders had strong beliefs about the consequences of exercising, and made positive evaluations of beneficial outcomes. In contrast low intenders held more neutral beliefs about the consequences of exercising, and were less convinced of the benefits of regular exercise. The same authors also reported a sex-related differential that traditional cultural values still influence the beliefs of junior high school students, where boys like to have fun and girls seek the benefit of looking better. The pervasive effect of attitudes is also reflected in adult studies, where Riddle (1980) reported that joggers had consistently and significantly more positive attitudes towards exercise than non-joggers. Although it should be noted that Dishman and Gettman (1980) using the inventory Attitude's Toward Physical Activity (ATPA), examined the psychobiological influence on exercise adherence, the results of which did not support the theoretical expectations related to the roles of attitudes towards physical activity in the adherence process.

The ATPA has been modified for children, and in its revised format, Children's Attitudes Towards Physical Activity (CATPA), Schutz et al. (1981) reported that attitudes towards physical activity and involvement are significantly related to each other. McCready and Long (1985) using the revised CATPA

reported two attitude variables, notably Social Continuation and Catharsis that are seen to be related to exercise adherence. Thus for the purposes of this study CATPA would appear to be the most appropriate method to elicit children's attitudes regarding physical activity. It therefore provides an effective psychometric tool to evaluate lifestyle orientation of children towards physical activity within the auspices of the present study. It should be further noted that there is an absence of research in South Africa seeking to understand lifestyle orientation of children by psychometric analysis, this is crucial because it could be, that the way an individual feels and perceives physical activity, may well be primary factors in their levels of participation when referenced with their level of achievement in traditional school sport.

Self-Concept

Self-perception is a fundamental aspect of the human organism. According to Gale (1974), man is a perceiving animal, since perceptions are the basis of the beliefs, feelings and values that trigger ones actions, contribute to ones development and guide ones learning. The same author states that by definition perception is an active process involving sensory experiences by means of which man selects, organizes and interprets all data one receives from both internal and external sources.

This unique and evaluative self-perceptual ability enables

the individual to critically discern the crucial factors and processes that comprise the 'self', the quintessence of which is to encapsulate what the self does and what the self feels.

These perceptions do not exist in the perceptual field as a simple enumeration of ways of seeing the self. Coombs *et al.* (1976) consider the concepts of self constitute an organisation representing a person's own conception of himself in all his complexity. This organisation is not a mere conglomeration of isolated concepts of self, but a patterned interrelationship or 'gestalt' of all perceptions (Coombs, 1958; Aboud, 1979). This organization of all the ways a person has of seeing himself has been coined the phenomenal or perceived self (Coombs *et al.*, 1976).

Out of the interaction of Man and his environment there emerges the self or a concept of "who I am" (Englar, 1979). This has been subsequently termed 'self-concept' (Rogers, 1961; Harter, 1983). The self, then, is an object of perception as well as a process. This is conceptually important to the present study when one considers the interactive process involved between the self and the object physical activity. Furthermore, self-concept is a function of processes emanating from within the individual (physically, mentally, emotionally) as well as those external factors, in particular interaction with and feedback from significant others. Positive self-concept, the feeling that one has value in the world, is a hall mark of good mental health. With the depersonalizing effects of

modern civilisation, the individual's ability to sustain a sense of worth is a requisite for happiness in all phases of life (Rowland, 1990). This continuous and ongoing process of comparison made between the self and others, whether it be conscious or unconscious, will play a significant role in the development of an individual's physical self-concept.

Gale (1974) reports that psychologists frequently find self-concept a useful construct to study people, because self-concept is central to human personality, from the viewpoint of human learning, the self-concept is the apex, the culmination of all the social and personal experiences man has had. The perception one has of oneself is developed during childhood. Non-existent at birth, self-concept is formed as the child grows, and mature self-esteem is typically reached at the time of adolescence. Thus, according to Caruso and Gill (1992) self-esteem is considered the evaluative component of self-concept and refers to an individual's positive feelings about himself or herself. Because it is difficult to consider oneself without experiencing self-evaluation, the two terms are often used interchangeably rather than confining description to self-concept and evaluation to self-esteem (Shavelson *et al.*, 1976). Hence the targeting of 16-18 year old students as subjects for the study, for it is proposed that by late adolescence, individual self-esteem in relation to physical activity is well established. Rowland (1990) indicates that self-concept grows largely by social experiences and therefore is derived from

one's cognitive, social and physical success in relation to peers. In this process experience of physical activity, particularly sport participation, are expected to influence the development of healthy self-esteem, particularly the value placed by society on athleticism and sports skills. Thus through this interactive process a central and underlying characteristic of the individual is developed, namely the internalisation of physical self-esteem.

Self-Esteem

Studies of children's self-conceptions by and large have been dominated by a focus on self-esteem (Wylie, 1979; Harter, 1983). In such studies the concern is with the positive or negative valence of a child's self regard, rather than with how the child defines and understands the self. This affective orientation of self-esteem has meant that its measurement in psychological studies has been conducted with a view to its direction and strength, in order to investigate whether the child values the self positively or negatively, and to what extent.

Self-esteem has consistently occupied a central position in the explanation of human behaviour (Gergen, 1971; Fox and Corbin, 1989). At present a rather substantial theoretical and empirical base supports the notion that a child's physical self-esteem, in the form of perceived ability, is a major determinant of future motivated behaviour in sport (Duda, 1987;

Horn, 1987; Weiss *et al.*, 1990). Sonstroem and Morgan (1989) indicate that self-esteem has been identified as the variable with the greatest potential to reflect psychological benefit gained from regular exercise, they go on to describe how it is practically impossible to consider a picture of oneself without experiencing self-evaluation and affect.

Self-Esteem Inventory Models

Early inventory constructs which sought to elucidate self-esteem, tended to emphasize unitary constructs, or global self-esteem and its ability to interact with, and influence behaviour in a wide variety of settings.

There is a substantial volume of research that has concluded that increased physical activity has a beneficial effect on mental health (Sonstroem, 1984; Morgan, 1985). Even so it is important to realize that mental health is a capacious term whose evaluation is beyond the scope of this study. Alternatively, self-esteem offers this study an important and stable component of mental health which is both manageable and assessable. However, although there appears to be a theoretical expectation of a positive relationship between self-esteem and more specifically physical fitness, Balogun (1987) reports that the resultant data examining these two factors have been inconsistent.

This is congruent with the finding of Damon and Hart (1988), who report that despite the seemingly central role of

children's self-esteem, psychologists have not succeeded in using it as a strong predictor of anything else. Wylie (1979) also acknowledges this point in a review of self-concept literature, and indicates that the most impressive thing which emerges is the widespread occurrence of null or weak findings in studies relating self-esteem to achievement, interpersonal relations and a host of other antecedent or consequent variables.

The apparent inadequacy of the self-esteem model in predicting behaviour patterns in terms of physical activity may well be the result of methodological limitations. According to Rowland (1990) the following factors appear to weaken the conclusion that exercise or physical fitness truly influences self-esteem; absence of proper control subjects, deficient experimental design, lack of random treatment assignment, initial group differences and improper statistical analysis.

In an attempt to construct and provide a better reasoned version of the self-esteem model Zion (1965), proposed that there was a significant relationship between body-image and self-esteem. Although this may be viewed in some respects as being conceptually circumscribed, in as much that it focuses predominately on self image (the appearance of the body and the positive or negative perception one has as a result), it does however provide the basis for studies producing significant correlations.

According to Tucker (1983a) those studies that place

emphasis on how the individual looked, reported significant positive relationships. Tucker (1983b) investigated the relationships between global self-esteem, somatotype, obesity, exercise and psychological well-being. He reported that looking good is a socially desirable quality, furthermore subjects who participated in regular weight training activities had healthier self-concepts than did subjects who exercised little, or not at all. Balogun (1987) reports similar findings, in terms of physical image, where individuals with high body fat have low self-esteem, and were less satisfied with their body parts and processes than were individuals with low body fat. Yet little significant relationships existed between global self-esteem and physical fitness, this is synonymous with the findings of Neale *et al.* (1969) and Leonardson and Gargiulo, (1978), illustrating the theoretical limitations of global self-esteem models, when investigating more specific factors such as physical activity and fitness.

It is perhaps important to note that for many people the preventative, long term health goals of adopting a physically active lifestyle, particularly in children may seem too intangible. For them, the sustained participation in physical activity may require more immediate benefits. These benefits might take the form of looking and feeling better, improved self-image, a greater satisfaction from improved physical performance, or a generally enhanced state of well-being (Dowall *et al.*, 1988; Mol, 1989).

A major advancement in self-esteem theory has been the widespread use of multi-dimensional means of investigation. The infusion of interactionism into self-esteem theory has produced a much richer picture of self-esteem content and provides a more informative map for plotting self-esteem change (Harter, 1985).

Fox and Corbin (1989) have noted that the multi-dimensional construct is not implicit in many self-esteem inventories, and consider that this has retarded the identification of the situational contributors to the physical self. They also note that the Tennessee Self-concept Scale (Fitts, 1965), the Physical Estimation Scale (Sonstroem, 1976) and the Physical Self-Efficacy Scale (Ryckman *et al.*, 1982) have suffered from problems similar to those of early uni-dimensional scales. Scales that are factor derived from a large item pool result in a conglomeration of often conceptually unrelated items.

Fox and Corbin (1989) in light of these theoretical inadequacies have developed a self-concept scale which deals with the relationship between self-esteem and physical activity in a far more rigorous and relevant model. They point out that the Physical Self-Perception Profile (PSPP) appears suitable to investigate the origins and mechanisms involved in the emergence of gender differences in self-perception in the physical domain. This model has also been successful in discriminating between active and non-active, as well as

between high active and low active individuals. Therefore it would seem that the more situational specific and multi-dimensional qualities of the PSPP, presently offers the most effective insight into how males and females perceive themselves in relation to physical activity within a traditional sports regime, along with an analysis of those individuals categorised as either high or low achievers.

Ratings of Perceived Exertion (RPE)

A common psycho-physiological tool used to assess perception of effort is Borg's rating of perceived exertion (RPE) (Hetzler *et al.*, 1991). According to Prusaczyk *et al.* (1992) RPE have been used increasingly for monitoring exercise intensity in clinical, rehabilitation, and fitness programmes, and in occupational settings because of their simplicity of use. The utilisation of the Borg scale in this study, provides a validated method of assessing how children perceive effort in the context of the MST, and an indication of whether or not high or low achievers are characterised by different perceptions of effort during a controlled exercise modality; for it has been proposed that what people think they are doing may well be more important than what they are doing.

Assessment of a physical task in a graded continuum, using terms such as light-weak to moderate to strong-hard, otherwise known as ratings of perceived exertion is, according to Borg (1982), the best single indicator of physical strain.

The rating of perceived exertion is indicated on Borg's RPE scale, by verbal anchors representing levels for perceived effort of exercise intensity (see Figure 1). The RPE scale is usually in the form of a chart which is placed in easy view, The subject is required to rate, at regular intervals his/her level of perceived exertion. The subject indicates which verbal anchor best describes his/her perception of effort, this may be a general or specific physiologic reference depending on the assessment criteria. ACSM (1986) report that perceived exertion scales provide a means to quantify subjective exercise intensity. The same authors indicate that such subjective estimates of exercise intensity by the person being tested have been found to correlate well (0.8 - 0.9) with oxygen uptake and heart rate.

RPE

6	
7	Very, very light
8	
9	Very light
10	
11	Fairly light
12	
13	Somewhat hard
14	
15	Hard
16	
17	Very hard
18	
19	Very, very hard
20	

FIGURE 1: Original Borg Scale.

New Rating Scale

0	Nothing at all
0.5	Very, very weak
1	Very weak
2	Weak
3	Moderate
4	Somewhat strong
5	Strong
6	
7	Very strong
8	
9	
10	Very, very strong
	Maximal

FIGURE 2: Revised Borg Scale

Mihevic (1981) noted that perception of effort was dependant upon input from both the musculature and cardio-vascular system and proposed that for prolonged work, perceived exertion is most forcibly influenced by those central factors of cardio-vascular function. While much of Borg's early work on the development of an RPE scale concerned itself with the relationship exhibited between effort induced bicycle ergometry and heart rate, his findings were equally applicable to treadmill exercise.

The original Borg scale had a 21 point category rating scale, which was later adapted to a 15 point scale to express greater linearity between ratings and workload (Borg, 1970). The numerical values used are representative of one tenth of exercise heart rates for healthy middle-aged men performing moderate to heavy exercise (Borg, 1973).

However there has been a tendency among some observers to incorrectly assume that RPE and heart rate are causally linked. Borg (1973) did in fact establish that in a number of exercise modalities that RPE covaries directly with heart rate, reporting a correlation of 0.85 between RPE values and heart rate response to a bicycle ergometer task involving progressively increasing exercise intensity intensities. This is commensurate with other findings using similar protocols (Pandolf *et al.*, 1972; Noble *et al.*, 1973; Skinner *et al.*, 1973).

However it should be noted that although the correlational

evidence suggests a strong linear relationship existing between RPE and heart rate in a number of exercise modalities, this relationship is less clear and much less substantial for a single exercise intensity, where Borg (1962) reported correlations averaging 0.4.

There appears to be a considerable consensus of support for the Borg scale as an accurate method of evaluating exercise effort. In fact criticism is difficult to find, although a less favourable conclusion was afforded by Miller *et al.* (1985), who investigated RPE and heart rate relationships of post 50 year olds in walking activities, and reported low correlation values in both the 600m walk and the 2min on-the-spot walk. The same authors point out that on any given day ones RPE and heart rate values may fluctuate with exercise as a result of physical, social or emotional factors.

RPE and Gestalt

Morgan (1981) points out that effort sense seems to involve a cognitive-perceptual process, rather than perception alone. Thus effort sense is based upon the physiological cost, cognition (thinking) and perception (feeling). This understanding leads to the proposal that effort perception is a complex psycho-physiological process

Morgan (1981), Borg (1982) and Boutcher *et al.* (1988) consider that effort perception is best viewed as "gestalt" a process that involves the interactive configuration of

numerous input parameters, such as muscle and blood lactate, ventilatory minute volume, catecholamine production, blood glucose levels, muscle glycogen stores, personality structure, pain tolerance, past experiences and memory, and probably opioid and neurotransmitter levels in the brain.

Mihevic (1981) indicates that the manner in which "gestalt" is established is not clearly understood, because effort perception is based upon a complex psycho-physiological process which Morgan (1981) describes as technologically inaccessible.

This however has not deterred researchers from seeking to understand more clearly this process (effort perception), and their work has often tended to focus on the identification of a primary cue underlying effort perception. The need for a conceptual framework for this research was recognised and Ekblom and Goldberg (1971) proposed a two factor model, of local and central parameters for the study of RPE. These authors recognised that the perception of effort might be dominated by local factors on the one hand, including physiologic factors such as lactate production, proprioceptor response and general limb muscle sensations; or central factors on the other hand including heart rate, oxygen consumption, ventilation and respiration rate depending upon the type of exercise modality.

The Revised Borg Scale

The 15 point Borg category scale was largely developed to express the linearity between RPE and heart rate (HR) in tasks involving progressively increasing exercise intensities. However certain physiological variables, notably pulmonary ventilation (breathlessness/dyspnea and respiration rate, RR) and lactate acid production do not increase in a linear pattern when an individual is subject to a test of maximal aerobic capacity (VO_2 max). According to Noble *et al.* (1983) when lactate is plotted as a function of the Borg (6-20) scale, lactate concentration increases about three times more per scale unit at the top of the scale ratings (16-17) than at the bottom. Thus a scale was needed that would identify fatigue associated with non linear physiological responses, such as pulmonary ventilation (dyspnea and RR) and lactate metabolism. It is important to note that VO_2 max tests and other similar incremental exercise modalities leading to a maximal aerobic effort are characterised by the subject achieving a ventilatory and lactate threshold, which are physiologically closely inter-related. Thus when the subject indicates that performance is limited or curtailed by muscle fatigue, this is caused by a failure of oxygen delivery to the mitochondrion. The consequences of local hypoxia are exacerbated by a slow diffusion of acid products out of the muscle fibre (Shephard, 1984). Furthermore, the inability of the subject to continue in a VO_2 max test may be the direct result of dyspnea. This is

supported by the findings of Adams *et al.* (1986) who report of an inverse association between levels of aerobic status as judged by HR and VO_2 criterion and the degree of reported breathlessness (dyspnea).

It is important to note that the perception of breathlessness or the degree to which one becomes out of breath during exercise is a commonly evaluated experience by 'normal' individuals according to Webber and Szidon (1986), and is not a term whose use is restricted to those individuals suffering from pulmonary illness or related conditions. Breathlessness as a perceptual reference medium is a particularly practical method, due to its customary monitoring, as in climbing a flight of stairs or going for a 10 km road run. More specifically Salamon *et al.* (1978) report that when conscious attention is focused on the acts of breathing, the quantitative appreciation of volumes, pressures and total ventilation conforms to psychophysical power functions in a manner similar to the perception of analogous parameters of other motor acts. It is therefore suggested that this quantitative evaluation of breathing during exerc ise is a function which is readily understood by children, especially as a perceptual cue during a test of aerobic capacity, and is a better term of reference than perhaps more nebulous terms such as fatigue.

As a result of the limitations demonstrated by the 15 point scale based on linear relationships Borg (1982) devised the new or modified 10 point category scale with ratio

properties (see Figure 2). Thus according to Carton and Rhodes (1985) this scale may be particularly useful in measuring the progression of effort with relation to certain physiological mechanisms such as dyspnea and lactate acid production, which reflect anaerobic metabolism (an important factor in VO_2 max tests especially in the latter stages) and grow according to a power function with exercise intensity. Mahon and Vaccaro (1989) report that the term ventilatory threshold has often been used synonymously with the term anaerobic threshold and is believed by some to be a noninvasive means of determining the onset of metabolic acidosis.

Noble *et al.* (1983) summarize that the usefulness of the new category-ratio scale is based upon the similarity in the psycho-physiological function and trend analysis between perceptual responses and physiological variables that exhibit a positively accelerating response to exercise intensity. In their research findings they report that the hypothesis that proposed that blood and muscle lactate would parallel perceptual ratings (1-10), while heart rate would not, were confirmed, thus the usefulness of the category-ratio scale was supported.

CHAPTER 3

METHODOLOGY

INTRODUCTION

The main aim of this study was to examine lifestyle orientation towards physical activity in children aged 16-18 years by means of an holistic model. This approach allows for an integrated profile, which due its multi-disciplinary construct provides a more consummate and accurate evaluation of individual lifestyle orientation towards physical activity.

More specifically, the methodology entailed anthropometric measures, included stature and mass, skinfolds and waist-to-hip ratio; physiological measures, included maximal predicted aerobic capacity (VO_2 max), along with exercise and pre-exercise heart rate monitoring; psychological measures included assessment of both attitudes towards physical activity and physical of self-perception, as well as the evaluation of ratings of perceived exertion (RPE).

SUBJECT CHARACTERISTICS

51 male and 53 female subjects aged 16-18 years were selected on the criterion of whether or not they were high or low achievers in traditional school sports. This criteria was based on the categorisation of high achievers being those subjects who performed in school first team, provincial or national level. Low achievers were categorised by their non-participation in the aforementioned team levels. This does not imply that low achievers were idle non-

participants, but rather that they had not achieved the criterion by which success in physical activity is largely measured, namely by being members of the traditional school first teams.

Subjects were therefore divided into four distinct groups; male high (Mhi) and male low achievers (Mlo), and female high (Fhi) and female low achievers (Flo).

RESEARCH PROTOCOL : INFORMED CONSENT

An initial letter and information sheet was sent to the headteachers of the High Schools in Grahamstown, informing them of the purpose of the study. A general outline of the requirements of the subjects was given as well as the data that would be collected during the sessions (see Appendix 1). The letter was followed up with a personal meeting with each of the headteachers to provide them with additional information with respect to the project, and to answer any queries they had. The headteachers were assured that the schools and the subjects anonymity would be preserved and that the pupils would be free to withdraw from the project at any stage.

As the subjects for the study were minors, the headteachers were requested to sign the informed consent form on behalf of the pupils, once they agreed to the participation of the pupils of their respective schools in the project.

PILOT TESTING

Pilot tests were conducted to evaluate primarily the reliability of testing procedures and equipment in the assessment of aerobic capacity (VO_2 max) along with heart rate and ratings of perceived exertion.

The use of the Multi-Stage Fitness Test (MST) for the prediction of VO_2 max, with minute by minute measurement of heart rate and ratings of perceived exertion does not appear to have been carried out before, therefore the pilot study was implemented to evaluate the feasibility and reliability of collecting data using this methodology whereby each subject was required to call out his/her own heart rate and RPE to the recorder at the stated interval.

As a result of feedback from the subjects and recorders in the pilot study, it was ascertained that an improved protocol procedure would be achieved if subjects called out heart rate first and then RPE. This was based on the finding that inter-individual influence in the calling out of heart rate was unlikely to be affected due to the objective nature of the reading. Whereas, by calling out RPE at the end of the shuttle, as opposed to halfway through the final shuttle of each level meant that the subject was in close proximity to the recorder and unlikely to be heard by other runners, thus the simultaneous rating by each subject nullified any adaption or suppression of perceptual responses.

ANTHROPOMETRIC DATA

In this study anthropometric measurements which centred on body composition (BC) were utilised. BC refers to the relative percentage of muscle, fat, bone and other tissue of which the body is comprised. The utilisation of BC is particularly germane to the present study because there is a need to establish if high and low achievers in traditional team sports are discernable by their morphology, and whether or not if one is able to identify certain undesirable corporal indices that are associated with various health problems, such as hypokinesis, which are often the result of sedentary lifestyles (Corbin and Lindsey, 1991). This point is reiterated by Lukaski (1987) who emphasized that BC has become a major field of interest for many sports and exercise scientists as well as clinicians who specialise in the prevention of, and rehabilitation from, hypokinetic disease.

The following anthropometric measurements were obtained from each subject; stature and mass, skinfold measures from four sites and waist-to-hip ratio.

Stature

Stature was measured using a Holtain stadiometer. Following the procedure proposed by Tanner (1964) each subject was asked to position his/her body so that his/her bare feet, buttocks and upper back were in contact with the stadiometer. The vertex in the medial sagittal plane was used to measure stature and was recorded in centimetres to the nearest millimetre.

Body Mass

The subject was asked to remove all clothing except for his/her shorts and T-shirt before being measured on the Seca scale. Body mass was measured in kilograms to the nearest gram.

Skinfold Measures

Measurement of skinfolds at selected sites offers an effective method of estimating body fat, a central factor in BC (Brodie, 1988).

Skinfold fat measurements - These were obtained using a Harpenden calliper, with a jaw pressure of 10 $g.mm^{-1}$, at four sites, namely triceps, biceps, subscapular and supra-iliac. Durnin and Womersley (1974) found that this procedure enabled the tester to assess total body fat with relative ease and reasonable accuracy. Measurement at all four sites involved the following steps. The skinfold was grasped between the thumb and the index finger, 1 cm above the prescribed site, and pressure applied. The skinfold was raised and maintained, with the crest of the fold following the specified alignment (Copley, 1980). The calliper jaws were then placed 1 cm from the fingers at a depth approximately equal to the thickness of the fold, at right angles to the prescribed site. The spring handles were released and the skinfold was held throughout the operation. The measurement was taken after the full pressure of the calliper jaws had been applied and the drift of the needles had stopped. Each measurement was taken and recorded to the nearest 0.1mm three times, and the mean of the closest pair recorded. All

measurements were taken on the right side of the body.

Triceps skinfold - This was measured on the posterior surface of the unclothed pendant arm at a level midway between the acromion and the olecranon. The midpoint was established with the elbow fixed at 90 degrees. The skinfold was lifted parallel to the long axis of the arm, after which the subject lowed the forearm and the calliper jaws applied.

Biceps skinfold - This was measured on the anterior surface of the pendant right upper arm, at the same level as the triceps skinfold. The skinfold was lifted parallel to the long axis of the upper arm.

Subscapular skinfold - This was measured 1 cm below the inferior angle of the scapular with the subject standing erect and the upper limbs pendant. The fold was measured in an oblique plane ascending medially at an angle of approximately 45 degrees to the horizontal.

Supra-iliac skinfold - This was measured 3 cm above the anterior superior iliac crest. The fold was taken in an oblique plane parallel to the crest.

The above procedures are in accordance with those outlined by Durnin and Womersley (1974). In order to assess percentage body fat for individuals, the body density has to be calculated first. This is done by adding the four skinfolds biceps, triceps, subscapular and supra-iliac, and then using the equations derived by Durnin and Womersley (1974). Density is then calculated from the following linear regression equation which estimates density from

the logarithm of skinfold thickness :

Density = c - m x log skinfold

where 'c' and 'm' vary in regression equations depending on age and sex.

The formula used to calculate % body fat is the Siri equation (as cited by Durnin and Wormersley, 1974) :

% body fat = (495/density) - 450

Waist-to-Hip Circumference Ratio (WHR)

The Waist-to-Hip ratio (WHR) measures topographic distribution of body fat and according to Van Itallie (1988), is one of the most effective methods for determining hypokinetic risk and disease.

The following steps were taken in making measurements and calculating the waist-to-hip ratio.

Both measurements were done with a non-elastic tape. The measurements were made while the subject was standing with his/her feet together and arms at the sides. The tape was held in a horizontal plane around the whole circumference of the body. The scores were recorded to the nearest millimetre for both circumferences. The tape was pulled snugly but not to the point of causing an indentation in the skin.

Waist measurement - This was made at the natural waist (smallest waist circumference). If there was no natural waist, the measurement was made at the level of the umbilicus. The measure was made at the end of normal inspiration.

Hip measurement - This was measured at the maximum

circumference of the buttocks. Measurement was made with the subjects in shorts or briefs so that the clothing did not add significantly to the measurement.

In order to calculate the subjects waist-to-hip ratio, divide the hip measurement into the waist measurement.

PHYSIOLOGICAL DATA

It is well cited in the literature that individuals who are characterised by desirable general fitness levels are more likely to be physically active and therefore at less risk to hypokinetic disease (Bouchard *et al.*, 1990; Gordon and Gibbons, 1991). Physiological assessment of the subjects was considered to be an important area for evaluation in order to see whether any significant differences existed between high and low achievers. The selected methods, which include aerobic capacity and heart rate, gave an accurate indication of physical work capacity, and are considered to be the best index of physical fitness (Baumgartner and Jackson, 1982).

Aerobic Capacity

The assessment of aerobic capacity is according to Noakes (1988) perhaps the most extensively used method in exercise physiology and is considered one of, if not the most important component of general physical fitness. Aerobic capacity was assessed by means of the Multi-Stage Fitness Test (MST) for the prediction of maximum aerobic uptake (VO_2 max) (Brewer *et al.*,

1988). The following items of equipment were required;

1. A flat non-slippery surface at least 20 m in length.
2. Cassette player.
3. The audio cassette.
4. Measuring tape to measure 20 m track.
5. Marker cones.

Subjects were asked to refrain from any heavy exercise three hours prior to the test for the prediction of VO_2 max. A 20 m track was measured and the ends marked with cones. Subjects were led through some basic stretching and warm up exercises in preparation for the test.

The cassette player was started. At the beginning, two bleeps indicate an accurately timed one minute interval. This was checked to ensure the tape had not stretched and that the speed of the cassette player itself was correct.

The tape continues with a brief explanation of the test, leading to a four second countdown to the start of the test. Thereafter the tape emits a single bleep at regular intervals. The subjects aim to be at the opposite end of the start by time the first bleep sounds. The subjects then continued to run at this speed, being at one end or the other each time there is a bleep.

After each minute, the time interval between the bleeps decreases making it necessary for the subjects to increase their running speed. The first running speed was referred to as 'Level 1', the second as 'Level 2', and so on. Each level lasts approximately one minute, and the tape continues up to Level 23.

The end of each shuttle is denoted by a single bleep; and the end of each level is denoted by a triple bleep and by a formal statement by the commentator on the tape.

The subjects were advised that the running speeds at the start of the test were very slow and to pace themselves accordingly. On level 1, subjects have nine seconds in which to run each 20 m shuttle.

Subjects were required to place one foot either on or behind the 20 m mark at the end of each shuttle. If the subject arrived at the end of the shuttle before the bleep sounds, he/she had to wait for the bleep before he/she could resume running and then adjust his/her running speed.

Each subject was encouraged to run as long as possible , until he/she was no longer able to keep up with the speed set by the tape, at which point the subject was withdrawn from the test. Each subject had his/her own recorder whose task was to tick off each shuttle and level completed by the subject, and then to record the level and the number of shuttles finally completed when the subject withdrew from the test. (see data sheet in Appendix 5).

Heart Rate

Heart rate measurements were taken because it is commonly recognised that they are indicative of the physiological strain of the cardio-vascular system during exercise (Armstrong and Bray, 1991).

Heart rate was measured by means of telemetric Uniq Heartwatch

which is a portable heart rate monitor. It has three components; viz the watch receiver, an electrode strap which was placed around the subject's chest at the level of the inferior border of the pectorals muscle; and the 'watch', which was attached to the subject's arm before the MST. It was set for 15 second monitor and display.

A pre-exercise heart rate was established prior to participation in the MST. This was given by the subject 15 seconds before he/she started to run in the test, and was determined by the 15 second countdown heard on the cassette. The subject thereafter, was instructed to call out the heart rate reading from the watch to the recorder towards the completion of each level/minute. This entailed the subject reading the heartwatch at a distance of 3 - 5 metres from the end of the final shuttle of each level and calling out his/her heart rate to the recorder who was positioned at the end of the shuttle. The recorder duly recorded the heart rate on the data sheet (see Appendix 5). This procedure continued until the subject was no longer able to keep up with the set rhythm of the MST and a final reading was taken at the point when the subject withdrew from the test.

PSYCHOLOGICAL DATA

Psychological indices were considered to be an essential component of the methodology as they may well be characteristic of significant differences between high and low achievers. It is clear that attitudes and self-concept are integral and important elements

of the individual persona and as a consequence may have a strong, if not determining influence, upon lifestyle orientation. Furthermore, these particular psychological indices, once they have been established in adolescence, are likely to be an ongoing and constant characteristic of the individual (Coombs *et al.*, 1976). It has been noted by Lamb (1992) that such indices provide considerable scope if one is seeking to ascertain physical lifestyle orientation.

Psychological Indices

Two psychological evaluative tools were employed in an attempt to quantify the psychological make-up of the subjects with respect to their attitudes towards physical activity and their self-perception in relation to physical activity.

The two scales were:

1. The Children's Attitudes Towards Physical Activity (CATPA) (Schutz *et al.*, 1981).
2. The Physical Self-Perception Profile (PSPP) (Fox and Corbin, 1989).

These inventories have been successful in discriminating between high and low active individuals and also sex-related differences.

The attitudinal test CATPA is modelled on the principle of a semantically differentiated scale. In an attempt to communicate feelings towards an object or some intangible concept, the individual is required to respond to bipolar adjectives and relate

these to the concept under appraisal, in this case physical activity. The CATPA inventory is a revised and improved version of previous attitudinal tests in terms of its specificity to physical activity, and provides a thorough analysis of the topic by organising the concept into seven sub-domains which include physical activity for social growth (Social Growth), physical activity to continue social relations (Social Continuation), physical activity for health and fitness (Health and Fitness), physical activity as a thrill but involving some risk (Vertigo), physical activity as beauty in movement (Aesthetic), physical activity for the release of tension (Catharsis), and physical activity as long hard training (Ascetic) (see Appendix 7).

If subjects do not understand a question, the option is provided for them to indicate that they do not understand, thus avoiding confounding data, however the authors of this test indicate in their studies that the sub-domain descriptions were well understood by the students.

The PSPP inventory is based on recent advances in self-esteem theory, particularly with respect to the use of multi-dimensional constructs for the study of self-perception in the physical domain. Open ended questionnaire responses were used to identify important contributory factors to the physical self-esteem of the subjects. The test consists of five 6-item subscales, designed to measure sports competence (Sport), perceived bodily attractiveness (Body), perceived physical strength and muscular development (Strength), perceived level of physical conditioning and exercise (Condition),

and physical self-worth (PSW) (see Appendix 8).

These questionnaires were administered at the first testing session involving the recording of base line data. The subjects sat on their own and answered the questions on the two papers in the allotted time. They were not allowed to communicate with one another during the session, and if they had any queries these were dealt with by the test administrator. The subjects were advised to answer the questions honestly and as they perceived them.

Ratings of Perceived Exertion (RPE)

Ratings of perceived exertion (RPE) have been described as the single best indicator of the degree of physical strain according to Borg (1982), and provide a perceptual and cognitive complement to physiological responses to exercise. In view of this psycho-physiological evaluative process, it was considered that RPE had a pivotal role to play in the present holistic model, which sought to explain variation in physical lifestyle orientation.

A number of perceptual cues may be used to evaluate exertion, these include general fatigue, local fatigue (usually arms or legs) and the feeling of breathlessness. Due to the nature of the MST it was considered that the feeling of breathlessness would provide the most reliable and relevant cue for individual evaluation of psycho-physiological processes.

The MST is a test for the prediction of VO_2 max and is characterised by linear incremental increases in exercise intensity; however, it was proposed that the sensation of

breathlessness under such an exercise protocol would increase in an exponential manner, and it was concluded that the use of Borg's revised scale (1982) with ratio properties would be the most appropriate method to monitor and record these data.

It should be clarified that the term breathlessness is synonymous with dyspnea and is, according to Webber and Szidon (1986), experienced by normal individuals and is not a term whose use is unique to those individuals suffering from a medical condition whose symptoms include dyspnea. The same authors point out that a sense of breathlessness may appear during recovery from vigorous activity, such as running up the stairs. Here, the level of ventilation (VE) for the degree of activity during recovery (i.e. standing) is perceived to be excessive. Alternatively, a level of VE to which the subject is not accustomed may elicit the sensation of breathlessness (i.e. prolonged vigorous running in a 'normal' individual). In either case, the chemical drive to respiration, mediated through the buffering of lactic acid and the heightened carbon dioxide production and fall in arterial pH, that is responsible for the elevated VE.

Measurement of RPE

Subjects were shown Borg's scale (1982) and familiarised with the principle that the numbers from 0 - 10 were descriptive of terms which represented their perception of breathlessness. Thus, '0' equalled nothing at all, '1' equalled very light and so on, until the subject on withdrawing from the MST indicated '10' which

equals very, very strong/maximal.

At the end of the 20 m track in which the subject was running a clearly readable RPE scale was presented (see Figure 1). At the end of each level/minute the subject was instructed by the recorder to give his/her perception of exertion in terms of how breathless he/she felt using the Borg scale. Thus the subject verbalised the number on the scale that most accurately reflected his/her perception of breathlessness at that point in time. This procedure was repeated at the end of each level/minute of the MST until a subject was no longer able to continue with the set rhythm of the MST and the final reading was taken at the point when the subject withdrew from the test.

TESTING SESSIONS

Due to the multi-faceted nature of this study, subjects were obliged to participate in three testing sessions.

Session 1: Entailed general demographic and base-line data. The base-line data included age and sex of the subject as well as his/her present level of involvement in traditional school sports, which fell into one of two distinct categories; high achievers, those individuals participating at first team level or higher and low achievers those individuals who did not participate at the aforementioned levels. The subjects were also required to fill in the two psychometric inventories CATPA, followed by the PSPP. The first session lasted about 45 minutes and involved the subjects as a whole group being present at one time.

Session 2: Entailed anthropometric measurement, which included stature and mass, four skinfolds and circumference of waist and hip. This session lasted about 10 minutes working with two to three subjects at a time.

Session 3: Entailed measurement of physiological and perceptual parameters including a reference (pre-exercise) heart rate 15 seconds before the start of the Multi-Stage fitness test for the prediction of maximum oxygen uptake, during which heart rate was continuously monitored, as well as ratings of perceived exertion (RPE) using the revised Borg scale. The third session lasted 30 minutes with the subjects working in groups of 5.

STATISTICAL ANALYSIS

The present study utilised the Statgraphics package, of which the following analyses were used: Basic descriptive statistics including means and standard deviations. One way ANOVA 0.05 level of confidence, and linear regressions.

CHAPTER 4

RESULTS AND DISCUSSION

The major objective of this study was to examine lifestyle orientations of 16 to 18 year olds by means of an holistic model, evaluating anthropometric, physiological, psychological and perceptual parameters of high and low achievers in traditional school sports.

The data are organised and presented in five subsections: Subject Characteristics, Anthropometric Results, Physiological Results, Psychological and Perceptual Results, followed by a general discussion.

SUBJECT CHARACTERISTICS

One hundred and four subjects participated in the study, of which 51 were males and 53 were females. The subjects were recruited from four schools in the Grahamstown area. Subject selection was based on an individual's level of participation in traditional school sports, therefore those subjects who were participants at school first team, or even provincial and national standard were categorised as high achievers. In the present sample there were a total of 56 high achievers, which comprised of male high achievers (Mhi) 27 and female high achievers (Fhi) 29. Those subjects who were not members of school first teams were categorised as low achievers. This sample consisted of 48 in total, which comprised of male low

achievers (Mlo) 24, and female low achievers (Flo) 24.

The mean age of the sample was 16.71 years (SD 0.63), the youngest being 16 years and the oldest being 18 years.

KEY: HIGH = High achiever
LOW = Low achiever
Mhi = Male high achiever
Mlo = Male low achiever
Fhi = Female high achiever
Flo = Female low achiever

TABLE I: Anthropometric results: means and standard deviations for all groups.

GROUP	STATURE (cm)	MASS (kg)	BODY FAT (%)	WHR
MALES	178.5 (6.2) *	70.3 (8.9) *	15.0 (3.6) *	0.80 (.04) *
FEMALES	164.3 (7.8)	60.7 (7.8)	26.8 (3.4)	0.75 (.07)
HIGH	172.9 (8.9) *	62.2 (10.4) 65.8 (9.2)	20.6 (6.4) *	0.78 (.06)
LOW	169.9(10.9)		21.6 (7.4)	0.77 (.06)
Mhi	178.8 (6.4)	72.4 (9.2) 68.2 (8.1)	14.8 (3.1) 15.3 (4.2)	0.80 (.04)
Mlo	178.3 (6.2)			0.76 (.02)
Fhi	167.1 (7.1) *	58.1 (5.7) *	25.9 (3.1) *	0.76 (.06)
Flo	161.5 (7.7)	63.4 (4.5)	28.0 (3.1)	0.74 (.08)

* indicates a significant difference at $p<0.05$

ANTHROPOMETRIC RESULTS

Noakes (1992) indicates that traditional school sports in South Africa are organised in a highly competitive structure and infers that as a consequence this system caters for the needs of the genetically gifted. If this contention holds true then one would envisage high and low achievers to be characterised by discernable anthropometric attributes.

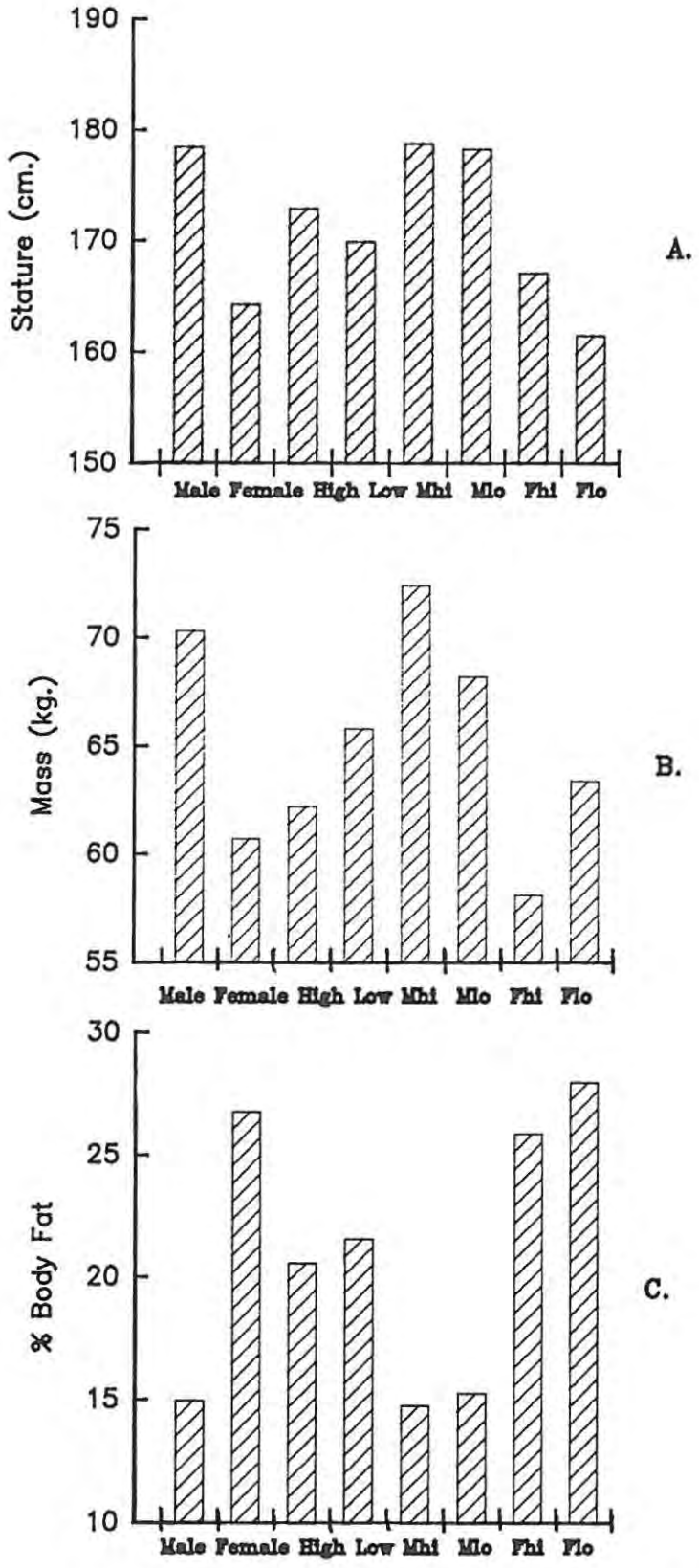


Figure 3. Anthropometric Mean Results of (A.) Stature, (B.) Mass and (C.) Body Fat for all groups

Stature

Males were considerably taller at 178.5 m than females who measured 164.3 m, this morphological difference between the sexes is a well documented one (Behnke and Wilmore, 1974). It was interesting to note that high achievers were significantly taller at a mean height of 172.9 m as compared with low achievers at 169.9 m. However on closer examination of the data it becomes apparent that this difference was in fact largely sex determined, because on the one hand there was a similarity in the mean height of Mhi (178.8 m) and Mlo (178.3 m), while on the other hand a substantial difference exists between the taller Fhi (167.1 m) and the shorter Flo (161.5 m). This is a somewhat perplexing result when one bears in mind that in the schools examined hockey is the major female sport, and that the tallest group were Fhi, which is contradictory to the findings of Scott (1991) who reports that elite South African hockey performers tend to be shorter in stature.

Body Mass

Males were on average heavier at 70.3 kg as compared to females with a mean mass 60.7 kg, this is consistent with previous reported differences between the sexes (Behnke and Wilmore, 1974). A relatively small divergence can be seen between high achievers (62.2 kg) and low achievers (65.8 kg), and this theme was similar for Mhi (72.4 kg) as compared to Mlo (68.2 kg). However it is clear that the greatest difference was between the mass of Fhi (58.1 kg) who were significantly

lighter than Flo (63.4 kg). It is also noticeable that Mhi (72.4 kg) were the heaviest group, while Fhi (58.1 kg) were the lightest. This inverse relationship between the mass of Mhi and Fhi may well reflect the influence of dominant gender based school teams activities. According to Van Dalen and Bennett (1971) perhaps the most important feature of the male school physical education and extra-curricula time table is the sport of rugby, where it is often desirable to be relatively heavier. This is not surprising when one thinks of the specific physical demands of scrumming, mauling and rucking and the physical contact involved in tackling. On the other hand the dominant female sport is hockey where speed and agility are essential attributes, and where it is advantageous to be relatively light in terms of body mass. Therefore it is not surprising to see that the mass of both Mhi and Fhi appear to be of a favourable type according to the demands of their gender specific sports.

Body Composition

Consistent with previous morphological assessments of body composition a significant difference in terms of percentage body fat was observed between males (15.09%) and females (26.83%). This is in accordance with the well documented biological and physiological differences that are characteristic of males and females (Wilmore, 1983; Corbin and Lindsey, 1991). More specifically McArdle *et al.* (1986) indicate that in females additional essential fat is

biologically important for child-bearing and other hormone-related functions.

High achievers with a percent body fat of 20.60% were lower when compared to low achievers (21.69%). However it is important to note that this difference is related to the influence of the low achieving female group (Flo). This is because Mhi (14.84%) and Mlo (15.37%) had similar mean scores, where as Fhi (25.97%) and Flo (28.00%) were significantly different. It is of interest to note that although male high and low achievers had similar scores for percentage body fat, Mhi were considerably heavier in terms of their mass. This indicates that although Mhi are heavier than Mlo, this increased mass is not made up of undesirable subcatanuous fat, which would be inhibitative for the high performance levels associated with first team inter-school competition. On the other hand Fhi were lower in percentage body fat than Flo, the result being that as a group Fhi were taller, lighter and leaner. These discerning morphological characteristics between high and low achieving females may well be the result of the competition and training that elite participation at school first team level demands. It should also be noted that some females, according to Tinning (1991) see the arena of competitive sport as a means for exercise involvement in the pursuit of a more desirable body shape. It is possible therefore that the present sample of Fhi may be composed of females who have an intrinsic desire to perform at this level,

and also those who see competitive sport as a means to an end, and that end being the desire to look physically more attractive.

In summing up the basic morphological characteristics of the subjects in the present study, one could conclude that the demands of traditional sports at first team level, most notably rugby for males and hockey for females, requires certain 'desirable' physical traits, or as Noakes (1992) suggests, genetic qualities. These trends are quite clear in the diagrammatical representation of the anthropometric data in Figure 3. The correlation between distinctive morphological characteristics and different athletic and sporting disciplines has been supported by previous authors, and most notably by Tanner (1964) in his extensive measurement and analysis of body types of Olympian athletes.

Waist-To-Hip Ratio (WHR)

According to Van Itallie (1988) WHR is the best available index for determining risk and disease associated with fat distribution. The same author has devised a WHR Rating Scale (see Table II) which can be used to evaluate individual risk for hypokinesis with regards to their WHR.

A significant difference in WHR occurred between males who have a ratio of 0.8 compared to females who scored 0.75 (see Table I). According to Gordon and Gibbons (1991) this sex-related difference is largely explained by the tendency for males to be characterised by 'android' fat deposition, that is

a predominant development of fat on the trunk and torso. Females on the other hand, are more likely to be characterised by 'gynoid' fat deposition, that is fat below the waist, more noticeable on the hips and thighs. According to Van Itallie's rating scale (see Table II) all groups of the present study fall into the lower risk category.

TABLE II: Waist-to-Hip Ratio (WHR) Rating Scale for risk of hypokinetic disease.

CLASSIFICATION	MALE	FEMALE
HIGH RISK	>1.0	>0.85
MODERATELY HIGH RISK	0.90-1.0	0.80-0.85
LOWER RISK	<0.90	<0.80

(Source : Data Van Itallie, 1988)

Bearing in mind the mandatory nature of physical activity in the schools, the reported high level of general fitness of South African schoolchildren according to Sloan (1965) and Andrews et al. (1980), and the relatively young age of the subjects these results are not surprising. It would appear that only Zwiaur et al. (1992) has specifically targeted child subjects, and found a some what predictable relationship with WHR and those who were obese. It is therefore tentatively suggested that the WHR is perhaps better suited to assessment of hypokinesis in adult populations.

PHYSIOLOGICAL RESPONSES

The total number of shuttles completed in the Multi-Stage Fitness Test (MST) by each subject gave an accurate prediction of their aerobic capacity (VO_2 max) (Brewer *et al.*, 1988). Table III represents the means and standard deviations of shuttles completed and predicted VO_2 max.

TABLE III: Means and standard deviations (SD) for number of shuttles run in the Multi-Stage-Fitness Test (MST) and predicted VO_2 max ($ml.kg^{-1}.min^{-1}$) for all groups.

Group	M	F	Hi	Lo	Mhi	Mlo	Fhi	Flo
$\bar{x}$ Shuttles	107.5	67.1	100.1	74.5	114.8	99.3	84.5	49.8
SD	21.43	22.42	22.30	31.1	18.61	21.3	12.8	15.7
VO_2 max	**54.3**	**41.8**	**51.9**	**43.3**	**57.1**	**51.4**	**47.4**	**36.4**
	*		*		*		*	

* indicates a significant difference at $p<0.05$

Males with a VO_2 of (54.3 $ml.kg^{-1}.min^{-1}$) were significantly different as compared with females (41.8 $ml.kg^{-1}.min^{-1}$). This physiological difference in aerobic capacity between males and females is a well documented one (McArdle *et al.*, 1986), and according to Noakes (1985) is largely the result of variance in body composition between the sexes. In the context of the present study the significantly decreased VO_2 max of females, especially the low achievers would appear to be equated with

additional mass (fat) is not useful for oxidative metabolism particularly in a test of maximal aerobic capacity. Furthermore the results of the predicted VO_2 max in this study compare well with previous research using similar age subjects (Bar Or, 1990; Wilmore and Costill, 1988). These data provide an indication that the sample was normative in respect to earlier studies which examined VO_2 in children and supports the notion that the MST is a valid methodological tool for predicting VO_2 max as proposed by Boreham *et al.* (1990).

The present study was also particularly concerned with the physical working capacity of the subjects by means of predicted VO_2 max, along with minute by minute monitoring of heart rate, and evaluating the differences that may exist between high and low achievers as a total group, as well as Mhi and Mlo, and Fhi and Flo. High achievers demonstrated a predicted VO_2 max score of (51.9 $ml.kg^{-1}.min^{-1}$), by virtue of running a greater number of shuttles which was indicative of a higher VO_2 max than low achievers (43.3 $ml.kg^{-1}.min^{-1}$).

Perhaps the most revealing results were observed when the sex of the group was taken into account with achievement level.

Congruent with previous research, the predicted VO_2 max score for Mhi (57.1 $ml.kg^{-1}.min^{-1}$) was higher than when compared to Mlo who scored (51.4 $ml.kg^{-1}.min^{-1}$). This trend was continued where the VO_2 max for Fhi was (47.4 $ml.kg^{-1}.min^{-1}$), was higher than for Flo (36.4 $ml.kg^{-1}.min^{-1}$); it should be noted that the difference between Fhi and Flo was much more pronounced than

between Mhi and Mlo. This is likely to be linked with the relatively higher body fat levels of Flo as compared to other groups in terms of a physiological explanation. A simple correlational analysis revealed that VO_2 max was inversely correlated with percentage body fat most noticeably with the two most bipolar groups Mhi and Flo. This was most clearly observed in Mhi ($r = 0.85$) and to a slightly lesser degree in Flo ($r = 0.50$). However these correlations were less impressive in Mlo ($r = 0.36$) and Fhi ($r = 0.27$), and may be indicative of the influence of other factors such as motivation, which is known to affect an individual's performance in a maximal test of aerobic capacity. Yet one should not ignore the fact that the low level of VO_2 max and a high percentage body fat of the low achieving female group may well be the result of a sporting experience manifested by marginalisation and a sense of alienation within the present school system.

Reference (Pre-Exercise) Heart Rate

The means and standard deviations for reference heart rate for all groups are presented in Table IV. A reference or pre-exercise heart rate was taken 15 seconds before the start of the MST.

It is a well documented phenomenon that the resting or pre-exercise heart rate of females averages 5 -10 beats faster than males under any given set of conditions (de Vries, 1982). Furthermore, the training level of the individual will have a

considerable bearing on heart rate, Noakes (1985) points out that the average resting heart rate for a trained individual

TABLE IV: Reference (pre-exercise) heart rates (HR): means and standard deviations (SD) for all groups.

Group	M	F	Hi	Lo	Mhi	Mlo	Fhi	Flo
Pre ex HR ($b.min^{-1}$)	94.6	100.7	94.25	101.7	90.1	99.6	98.0	103.9
SD	17.43	14.21	13.30	18.13	11.75	21.33	13.73	14.39
	*		*					

*** indicates a significant difference at $p<0.05$**

(male and female) is 60 $b.min^{-1}$ versus in the untrained individual 75 $b.min^{-1}$ Therefore bearing in mind that the present sample were comparatively analyzed according to sex and level of achievement, it is not surprising that the reference heart rate of males (94.9 $b.min^{-1}$) was significantly lower than females (100.9 $b.min^{-1}$), that high achievers (94.1 $b.min^{-1}$) was significantly lower than low achievers (101.7 $b.min^{-1}$), that Mhi (90.1 $b.min^{-1}$) was lower than Mlo (99.6 $b.min^{-1}$) and that Fhi (98.0 $b.min^{-1}$) was lower than Flo (103.9 $b.min^{-1}$). The results from the present study are very much in accordance with the findings of previous research including DeMaria *et al.* (1978) who pointed out that regular physical activity of an aerobic nature improves cardiac efficiency by increasing stroke volume and reducing heart rate at rest.

Exercise Heart Rate

Examination of minute by minute heart rate measurements presents an accurate representation of the physiological strain experienced by subjects during participation in the MST (Armstrong and Bray, 1991). It is clear from the trends displayed in Figures 4ab and 5ab that there was a discernable difference in the way in which physiological strain was experienced by the paired groupings. The mean heart rate at each level up until termination point in the MST was less for males than for females, less for high achievers compared to low achievers, less for Mhi than for Mlo, and less for Fhi compared to Flo. Furthermore the differences in these heart rate scores for each paired analysis were statistically significant for a substantial number of levels during the MST. Males and females display a significantly different heart rate during levels 1-8; high and low achievers during levels 1-8; Mhi and Mlo during levels 1-11; and Fhi and Flo during levels 1-5.

These findings are commensurate with McArdle *et al.* (1986) that females experienced greater physiological strain as demonstrated by heart rates higher than males for any given exercise intensity. This was also true of the groups with less experience of sport and exercise (low achievers) as compared with the elite performers (high achievers), supporting the contention made by Noakes (1985) that at any given exercise intensity, elite performers report lower heart rates.

TABLE V: Means and standard deviations (parenthesis) of exercise heart rate for males, females, high and low achievers.

MST LEVEL	MALES $b.min^{-1}$	FEMALES $b.min^{-1}$	HIGH $b.min^{-1}$	LOW $b.min^{-1}$
0	94.90 (17.43)	100.99 (14.21)	94.10 (13.30)	101.79 (18.13)
1	142.05 (14.06)	153.28 (13.38)	142.85 (12.77)	152.47 (15.41)
2	153.07 (13.48)	167.36 (11.52)	154.59 (12.70)	165.85 (14.02)
3	160.27 (13.79)	173.07 (11.41)	160.97 (12.91)	172.36 (13.32)
4	166.57 (13.91)	179.79 (10.34)	166.64 (12.94)	179.72 (11.72)
5	172.84 (13.03)	184.89 (9.26)	173.05 (12.65)	184.68 (10.08)
6	177.76 (11.53)	188.14 (9.31)	178.51 (11.63)	187.39 (10.07)
7	183.33 (10.49)	191.18 (7.56)	183.99 (10.46)	190.52 (8.51)
8	186.64 (9.57)	196.37 (8.29)	188.03 (10.08)	194.98 (9.47)
9	190.38 (9.34)	195.90 (7.70)	191.13 (9.45)	195.15 (8.54)
10	191.58 (8.33)	199.35 (9.03)	192.57 (9.30)	195.64 (8.39)
11	193.62 (6.83)	197.75 (7.22)	193.14 (6.42)	196.36 (7.80)
12	194.88 (7.07)		193.63 (6.35)	197.44 (7.81)
13	196.60 (6.17)		195.66 (6.61)	200.33 (0.57)
14	201.40 (8.14)		201.50 (9.33)	

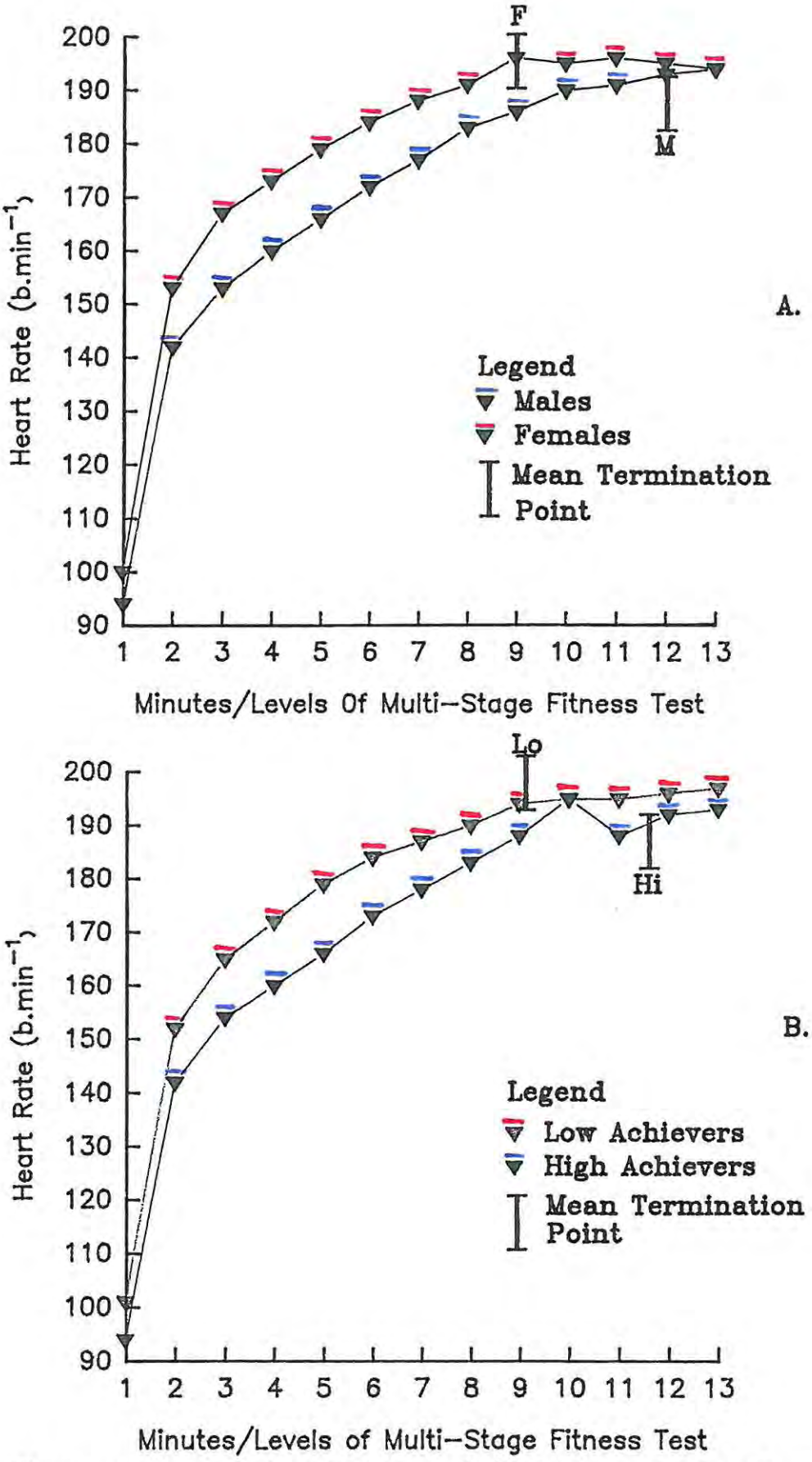


Figure 4. Mean Heart Rate for (A.) Males and Females and (B.) High and Low Achievers.

TABLE VI: Means and standard deviations (parenthesis) for exercise heart rate for male high achievers (Mhi), male low achievers (Mlo), female high achievers (Fhi) and female low achievers (Flo).

MST LEVEL	Mhi $b.min^{-1}$	Mlo $b.min^{-1}$	Fhi $b.min^{-1}$	Flo $b.min^{-1}$
0	90.18 (11.75)	99.62 (21.33)	98.03 (13.73)	103.95 (14.39)
1	136.85 (12.03)	147.25 (14.37)	148.86 (10.67)	157.70 (14.89)
2	146.74 (11.37)	159.41 (12.67)	162.44 (8.60)	172.29 (12.44)
3	152.33 (10.63)	168.20 (12.11)	169.62 (8.55)	176.52 (13.45)
4	158.14 (10.87)	175.00 (11.42)	175.13 (8.68)	184.45 (10.13)
5	164.51 (9.72)	181.16 (10.44)	181.58 (9.02)	188.20 (8.34)
6	171.07 (9.27)	184.45 (9.65)	185.96 (8.69)	190.33 (9.88)
7	176.96 (7.46)	189.70 (9.31)	191.01 (8.04)	191.33 (6.18)
8	181.07 (6.35)	192.21 (9.29)	195.00 (8.11)	197.75 (10.50)
9	184.96 (6.40)	195.81 (8.93)	197.30 (8.00)	194.50 (0.70)
10	188.92 (7.72)	195.64 (8.39)	199.35 (9.03)	
11	192.37 (6.10)	196.36 (7.80)		
12	193.61 (6.53)	197.44 (7.81)		
13	195.66 (6.61)	200.33 (0.57)		
14	201.50 (9.33)			

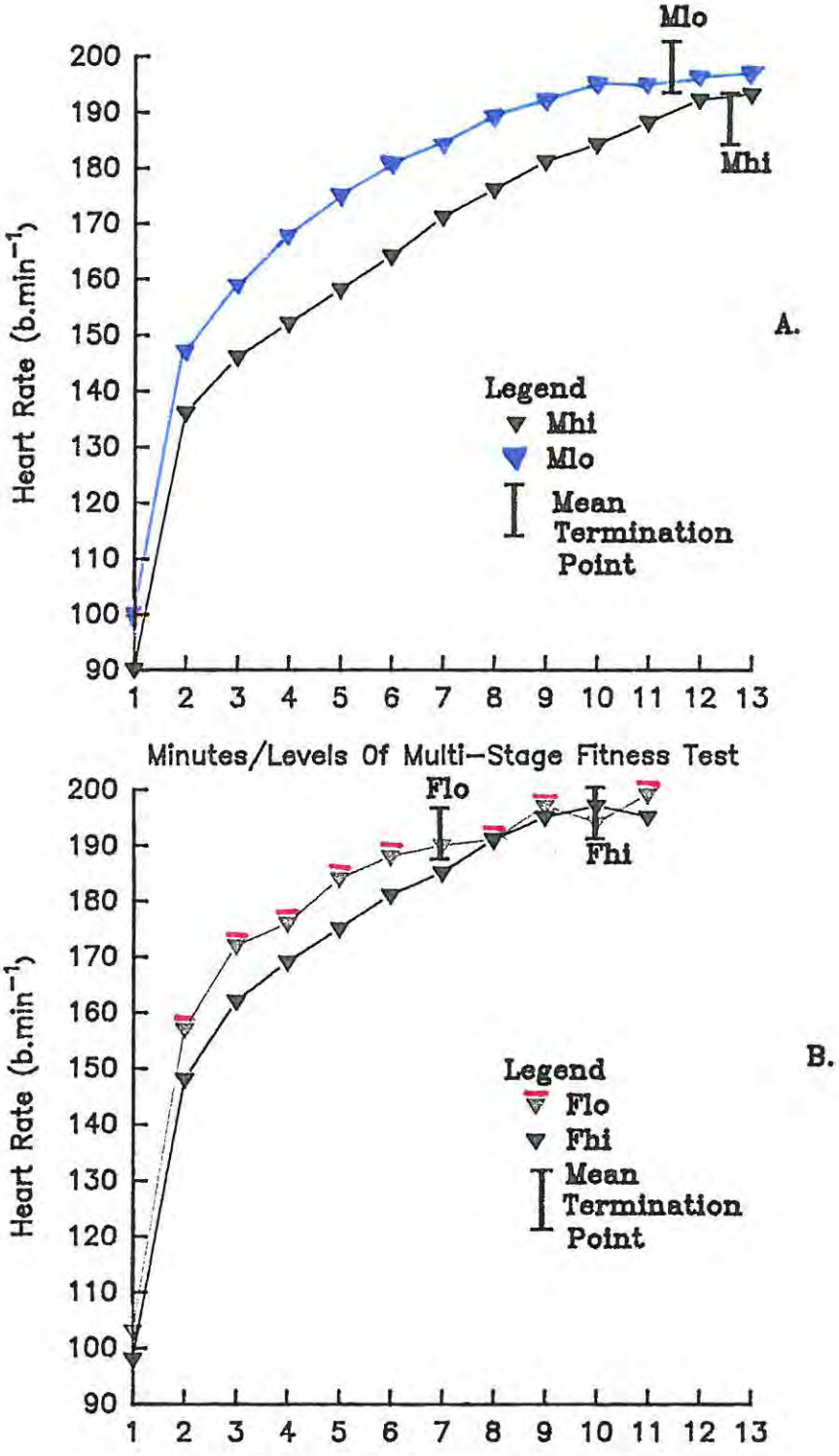


Figure 5. Mean Heart Rate in (A.) Mhi and Mlo and (B.) Fhi and Flo.

It is perhaps pertinent to note that the maximal heart rate that is likely to be attained by this group of subjects aged 16 - 18 years is 202 to 204 beats per minute, based on the calculation that maximal heart rate is 220 minus age. It would appear that all of the groups recorded a final heart rate, at the group mean termination point, which was indicative of a near maximal effort (see Table V and VI). However, if one observes the heart rate trends particularly during the final five levels/minutes of the MST, it becomes apparent that there was a difference in how each of the groups experience the physiological strain of this test. This is most conspicuous when one compares the penultimate five minutes of exercise of the two most contrasting groups, Mhi and Flo. Closer examination of the data in graphic form (Figure 6) illustrates that Mhi were able to sustain an effort level which is near to their maximal effort for the five levels prior to termination point in the MST, this is apparent from the plateau effect of their heart rate plot. While Flo exhibit a heart rate which increased in a more accelerating trend at each of the final five levels of the MST until termination point. This suggests that for a number of possible reasons including training experience, motivation, and genetic predisposition, that Mhi are better equipped to sustain a greater level of physiological strain for longer, particularly when compared to Flo.

In concluding the physiological data which sought to evaluate the aerobic capacity and which according to Corbin and

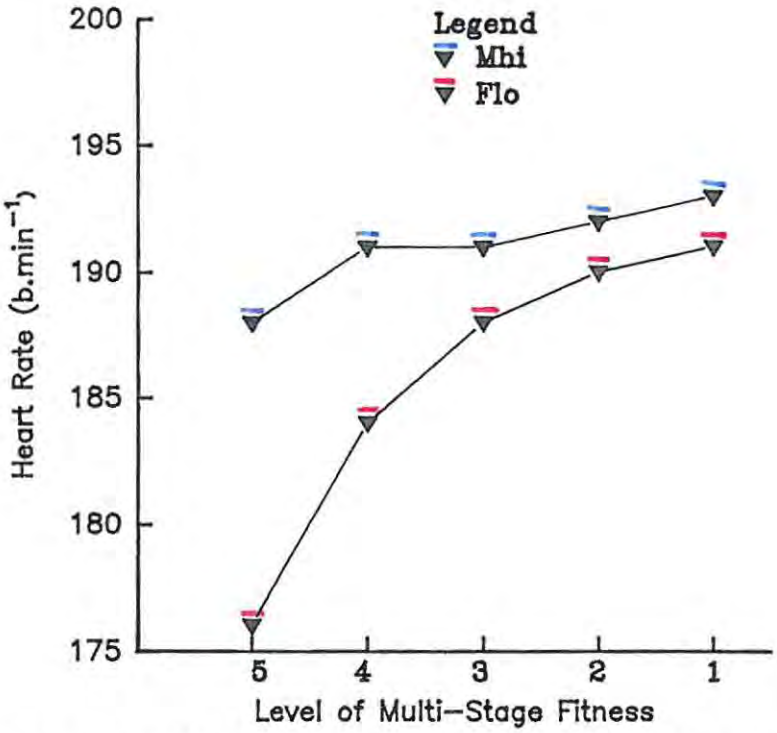


Figure 6. Mean Heart Rate for the 5 final levels of the Multi-Stage Fitness Test for Mhi and Flo.

Lindsey (1991) is the most important aspect of general physical fitness along with minute by minute monitoring of heart rate, it is apparent that the results are consistent with previous studies. The data show that differences occurred between the sexes as well as between high and low achievers. However the most interesting findings concern the disproportionately (in terms of the present sample) low VO_2 max scores of the low achieving female group, and the distinctive linear plot of heart rate that is exhibited in Figure 5b. Not only did the Flo achieve a relatively low VO_2 max, but the physiological strain that they experienced increased in a linear mode to a peak point, indicating that each level of the test was more strenuous than as experienced by Mhi, Mlo and Fhi, culminating in Flo withdrawing immediately they reached their near maximal heart rate. This was in contrast to the other groups Mhi, Mlo and Fhi who were able to sustain a near maximal heart rate in the final phase of the MST, which appears on the graph as a plateauing effect. One might have assumed that the physiological differences between Mhi and Mlo would be similar to Fhi and Flo, however this does not appear to be the case, with Flo being clearly identifiable with respect to their less desirable physiologic and anthropometric profiles.

PSYCHOLOGICAL RESULTS

Psychological evaluation of subjects in the present study focused on two areas, namely attitudes and physical self-

perception. Recent developments in the use of psychometric analysis, particularly with regard to Children's Attitudes Towards Physical Activity (CATPA) Schutz *et al.* (1981) and the Physical Self-Perception Profile (PSPP) Fox and Corbin (1989) provide the researcher with two validated techniques which explain the central role that both attitudes and physical self-perception play in determining human behaviour in relation to physical activity (Gergen, 1971; Fox and Corbin, 1989). The use of these two inventories provides two conceptually different perspectives. CATPA evaluates an individual's externalised appraisal of the object/idea (physical activity), that is how he/she perceive physical activity. While on the other hand PSPP evaluates a more internalised perspective regarding the affective influence of physical activity on the self. In other words, CATPA is an outward looking perspective, where as the PSPP is an inward looking one.

Attitudes

The CATPA inventory enables the researcher to study an individual's attitudinal response to physical activity with an improved analytical format which organises the concept into seven sub-domains; Social Growth, Social Continuation, Health and Fitness, Vertigo, Aesthetic, Catharsis, and Ascetic. The means and standard deviations for all groups are represented in Table VII and the graphic representation of the data is shown in Figures 7ab and 8ab. Individuals who are characterised by

positive attitudinal responses will have higher mean scores and a plot or trend in the graphic representations of the data which is also higher on the vertical axis in comparison to those individuals who respond in a more negative manner.

Examination of male and female attitudinal responses as elicited by CATPA indicates that there was a significant difference in three of the sub-domains; Social Growth, Aesthetic and Vertigo. These responses appear to indicate that females are more positive with regard to Social Growth, inferring that sport is important as a medium for social interaction. Also the positive response to the Aesthetic sub-domain (females 5.4 and males 2.9) may well be a reflection of the greater implementation of more creative and expressive activities, such as dance and synchronised swimming, and as a consequence provides females with a greater understanding and appreciation of this subjective concept.

Males (3.8) scored higher than females (1.4) in the Vertigo sub-domain possibly indicating that their gender specific exposure especially to the physical contact sport of rugby, endears them to sports with an element of risk or danger.

When comparing the responses of high and low achievers one observes a consistent trend, whereby high achievers score more

TABLE VII: Children's Attitudes Towards Physical Activity (CATPA): means and standard deviations for all groups.

GROUP	SOCIAL GROWTH	SOCIAL CONTINUATION	HEALTH AND FITNESS	VERTIGO
MALES	6.9 (2.5) *	7.6 (2.3)	7.0 (2.8)	3.8 (4.0) *
FEMALES	7.9 (2.6) *	7.9 (2.6)	7.6 (3.0)	1.4 (4.9) *
HIGH	8.0 (2.5) *	8.3 (2.2) *	8.0 (2.6) *	4.4 (3.7) *
LOW	6.8 (2.6) *	7.2 (2.6) *	6.6 (3.1) *	0.8 (4.9) *
Mhi	7.4 (2.5)	7.9 (2.6)	7.6 (2.6)	5.0 (2.8) *
Mlo	6.4 (2.3)	7.4 (2.0)	6.5 (3.0)	2.6 (4.8) *
Fhi	8.5 (2.4)	8.8 (1.8) *	8.4 (2.6) *	3.7 (4.3) *
Flo	7.3 (2.8)	7.1 (3.1) *	6.7 (3.3) *	0.8 (4.5) *
GROUP	**AESTHETIC**	**CATHARSIS**	**ASCETIC**	**TOTAL SCORE**
MALES	2.9 (4.4) *	6.5 (4.0)	1.6 (4.2)	36.6 (14.8)
FEMALES	5.4 (4.3) *	7.3 (3.6)	0.1 (5.3)	37.7 (16.4)
HIGH	4.1 (4.5)	7.4 (3.4)	2.6 (3.2) *	43.0 (14.9) *
LOW	4.2 (4.6)	6.3 (4.3)	-1.0 (4.8) *	31.3 (14.0) *
Mhi	3.2 (4.2)	6.4 (4.2)	2.6 (3.9)	40.4(16.0)
Mlo	2.5 (4.8)	6.6 (3.9)	0.7 (4.4)	32.8(12.5)
Fhi	5.0 (4.8)	8.5 (1.9) *	2.5 (1.6) *	45.6 (13.6) *
Flo	5.9 (3.7)	6.1 (4.7) *	-2.3 (4.9) *	29.8 (15.5) *

* indicates a significant difference at $p<0.05$

KEY FOR FIGURES 7 & 8:

Social = Social Growth
Health = Health & Fitness
Aesth = Aesthetic
Ascet = Ascetic
Scont = Social Continuation
Vert = Vertigo
Cath = Catharsis

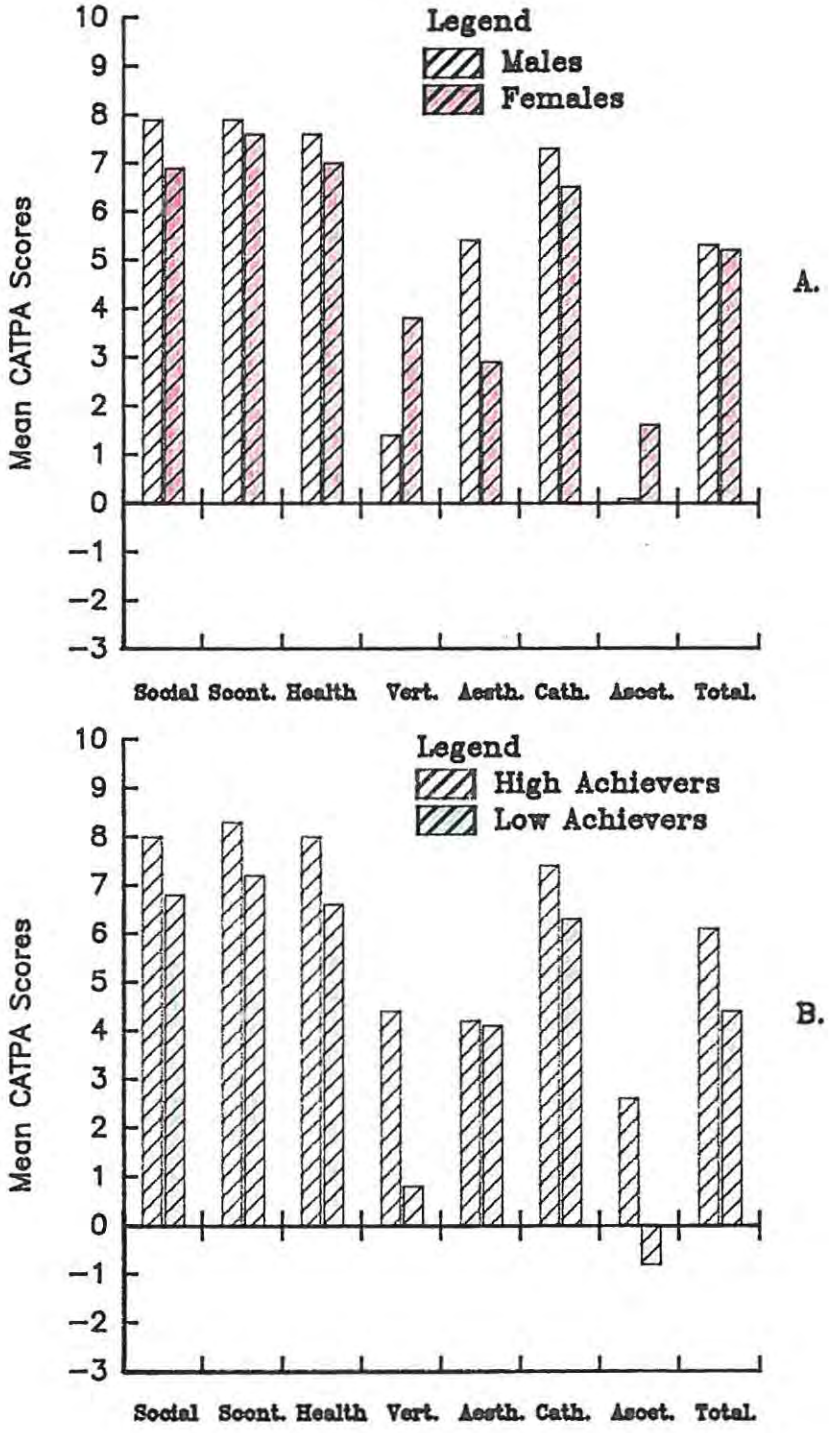


Figure 7. Mean Scores for Children's Attitudes Towards Physical Activity (CATPA) in (B.) Males and Females ; (A.) High and Low achievers.

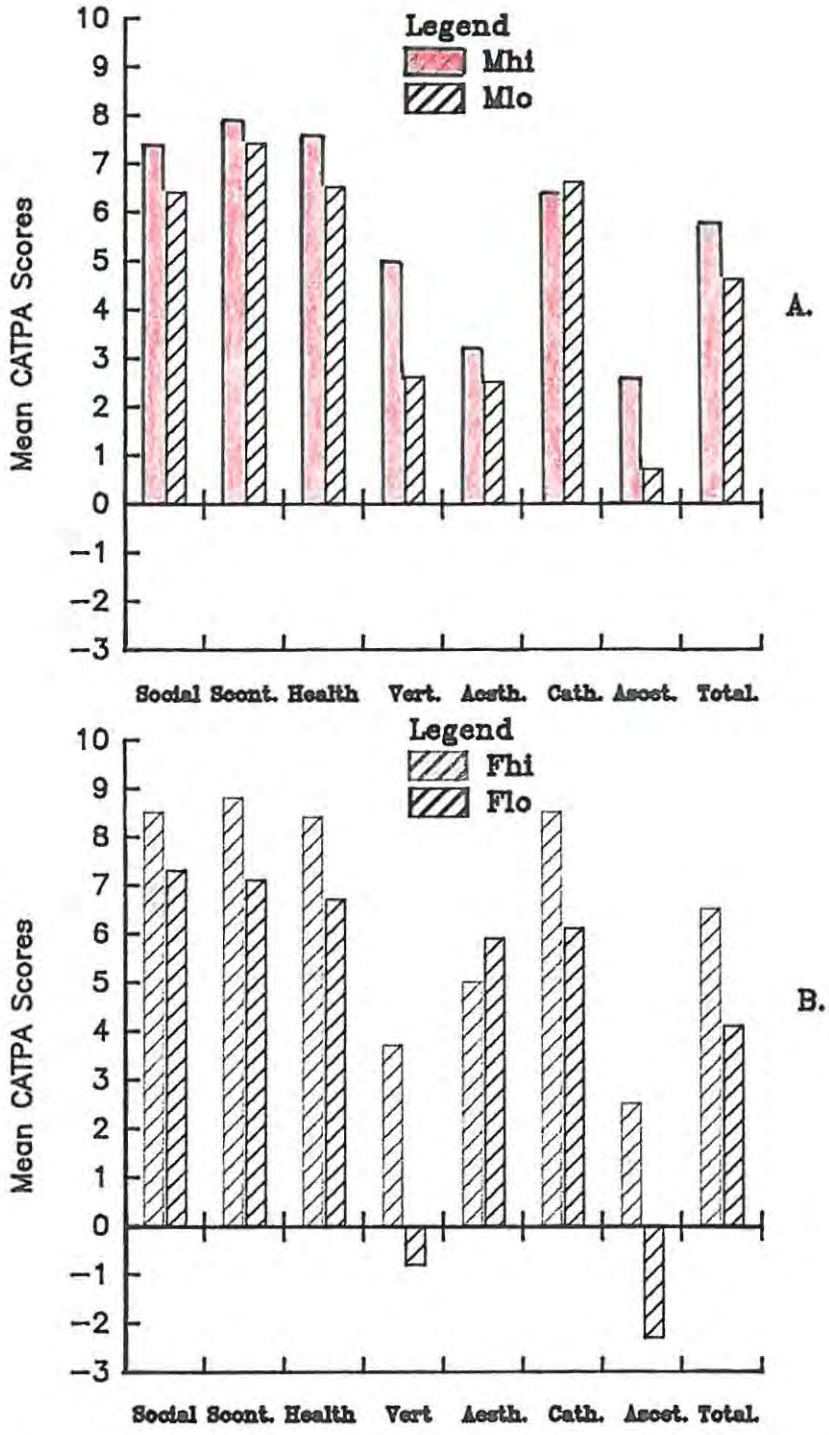


Figure 8. Mean Scores for Children's Attitudes Towards Physical Activity (CATPA) in (A.) Mhi and Mlo and (B.) Fhi and Flo.

positively than low achievers in every sub-domain of CATPA, and this is further emphasised with the difference being significant in five areas viz; Social Growth, Social Continuation, Health and Fitness, Vertigo and Ascetic (see Table VII). These differences illustrate that high achievers compared to low achievers were significantly more positive when perceiving physical activity as a medium for meeting new people, as well as an opportunity to be with friends. High achievers also indicated that they perceived physical activity to improve one's health and to be beneficial for general body condition. They were also more positively orientated towards sports with an element of risk and were better predisposed towards practising and training for preparation in sports activities as indicated by their responses in the Ascetic sub-domain. An interesting aspect of this comparative analysis was the lack of difference shown in the different groups' attitudes towards the Aesthetic sub-domain high achievers (4.1) and low achievers (4.2). Bearing in mind that these two groups have been categorised according to their achievement level in competitive sports, and that their value judgement of what is qualitative in sport is based often on objective criteria such as speed, strength and points scoring, it is not surprising that a sample of high and low achieving subjects selected out of such a competitive environment based on objective criteria appear to have an almost undifferentiated attitudinal response toward the aesthetic elements in physical activity; this may be

due to the subjective nature of aesthetic responses.

When comparing Mhi with Mlo it was noticeable that these two groups were characterised by their lack of difference, and it was only in the sub-domain of Vertigo that a significant difference between the two groups was apparent where male high achievers scored higher than male low achievers. This may be the result of the Mhi group being largely comprised of 1st team rugby players; rugby being an activity which relates most closely in the terminology of the CATPA inventory as the sport being characterised by risk and danger. Other than the response to Vertigo there appears to be considerable homogeneity in the male subjects as to their attitudes towards physical activity, possibly reflecting the strong societal and cultural pressures to conform to the sporting norms of traditional school sport, especially rugby (White and Vagi, 1990).

Conversely the two female groups exhibit the greatest dichotomy of any paired group. Fhi, according to the results of the CATPA inventory, were the most positively orientated of all the groups (including Mhi) with a total score of 45.6, while Flo emerge as the least positive with a total score of 29.8. A significant difference between the two groups was evident in five of the sub-domains; Social Continuation, Health and Fitness, Vertigo, Catharsis and Ascetic. Thus Flo constitute the most distinctive group, due to their negatively orientated scores in the CATPA inventory. This negative perspective of physical activity, would imply that for a number of possible

reasons the traditional school sports structure does not fulfil the needs of the female low achieving group and might be better described as serving to alienate this group from participating in physical activity. Differentiated gender-based responses to attitudinal tests were also reported by Godin and Shephard (1986), who reported in their study of American high school children that gender behaviours in sport appear to be largely affected by traditional cultural values, which are manifested by males participating in sport with both greater frequency and intensity than females. Attitudinal responses from the present study are somewhat contradictory when compared to the findings of Godin and Shephard (1986), for although it is clearly evident from the data that Flo are, in relative terms, obviously attitudinally less predisposed to physical activity, the opposite can be said for Fhi, who exhibit the highest responses of all groups examined. These results suggest that it is sensible to evaluate both the influence of sex and achievement level when analyzing attitudinal data, if one wishes to make a better informed assessment of the individual and group dynamics.

Physical Self-Perception

The Physical Self-Perception Profile (PSPP) Fox and Corbin (1989) is an inventory which has a multi-faceted composition, enabling the researcher to evaluate the concept of the physical self in a more germane manner, utilising five "subscales";

Sport, Condition, Body, Strength and Physical Self-Worth (PSW). Perhaps the most compelling theme to be identified from the PSPP was that for every paired analysis the groups males, high achievers, Mhi and Fhi scored higher than their group counterpart in all subscales. This can be clearly seen in the means and standard deviations for all groups in Table VIII and the graphic representation of these data in Figures 9ab and 10ab.

Fox and Corbin (1989) indicate that the PSPP is a suitable method for investigating the origins and mechanisms of sex differences in the domain of physical self-perception. When analyzing results from the present study, one can observe a distinctive sex-related trend, where males score higher than females, and this trend is exemplified by the fact that these differences are significant in four of the five subscales; Sport, Condition, Body and PSW. These results illustrate that the males in the present study had an elevated perception of their physical self as compared to females, suggesting that male expectation with regard to their introduction and experience of traditional team sport, is something which is socially and culturally easier and appropriate for them to assimilate and internalise. The lowered sense of physical self-worth of females suggests that the realm of competitive team sports is in some way perceived as inappropriate for female participation and enjoyment due to gender expectations by society in general (Hall, 1990).

Table VIII: Physical Self Perception Profile (PSPP): means and standard deviations for all groups.

GROUP	SPORT	CONDITION	BODY
MALES	17.2 (3.5) *	17.4 (3.3) *	15.5 (3.1) *
FEMALES	14.0 (3.7)	14.5 (4.5)	11.7 (4.8)
HIGH	17.8 (3.0) *	18.2 (2.9) *	15.4 (4.8) *
LOW	13.4 (3.6)	13.7 (4.1)	11.8 (4.6)
Mhi	19.4 (1.9) *	18.8 (2.6) *	16.0 (2.2)
Mlo	15.0 (3.4)	16.0 (3.4)	15.0 (3.80
Fhi	16.2 (3.0) *	17.6 (3.1) *	14.8 (4.5) *
Flo	11.8 (3.5)	11.4 (3.4)	8.5 (2.6)
GROUP	STRENGTH	PSW	TOTAL 3
MALES	14.9 (3.2)	16.8 (3.4) *	82.2 (19.2) *
FEMALES	14.1 (4.0)	13.3 (4.4)	67.7 (13.1)
HIGH	15.5 (3.2) *	16.7 (3.6) *	83.9 (13.3) *
LOW	13.5 (3.7)	13.3 (4.4)	66.0 (17.7)
Mhi	15.4 (2.6)	17.7 (2.9)	87.4 (9.2) *
Mlo	14.5 (3.7)	16.0 (3.7)	77.1 (14.8)
Fhi	15.6 (3.8) *	15.8 (3.9) *	80.4 (15.6) *
Flo	12.6 (3.7)	10.7 (3.3)	54.9 (12.8)

* indicates a significant difference at $p<0.05$

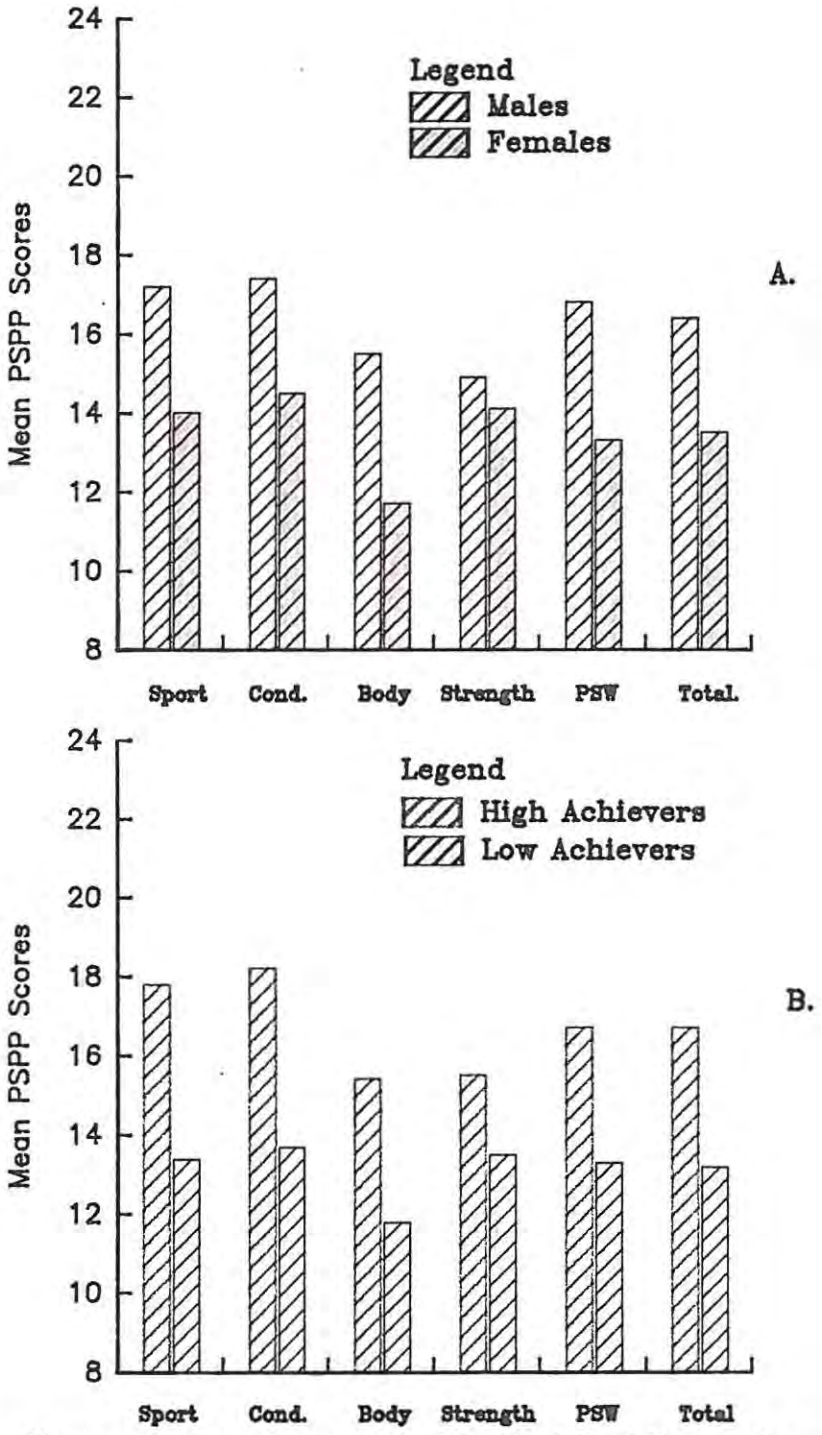


Figure 9. Mean Scores for Physical Self Perception Profile (PSPP) in (A.) Males and Females;(B.) High and Low Achievers.

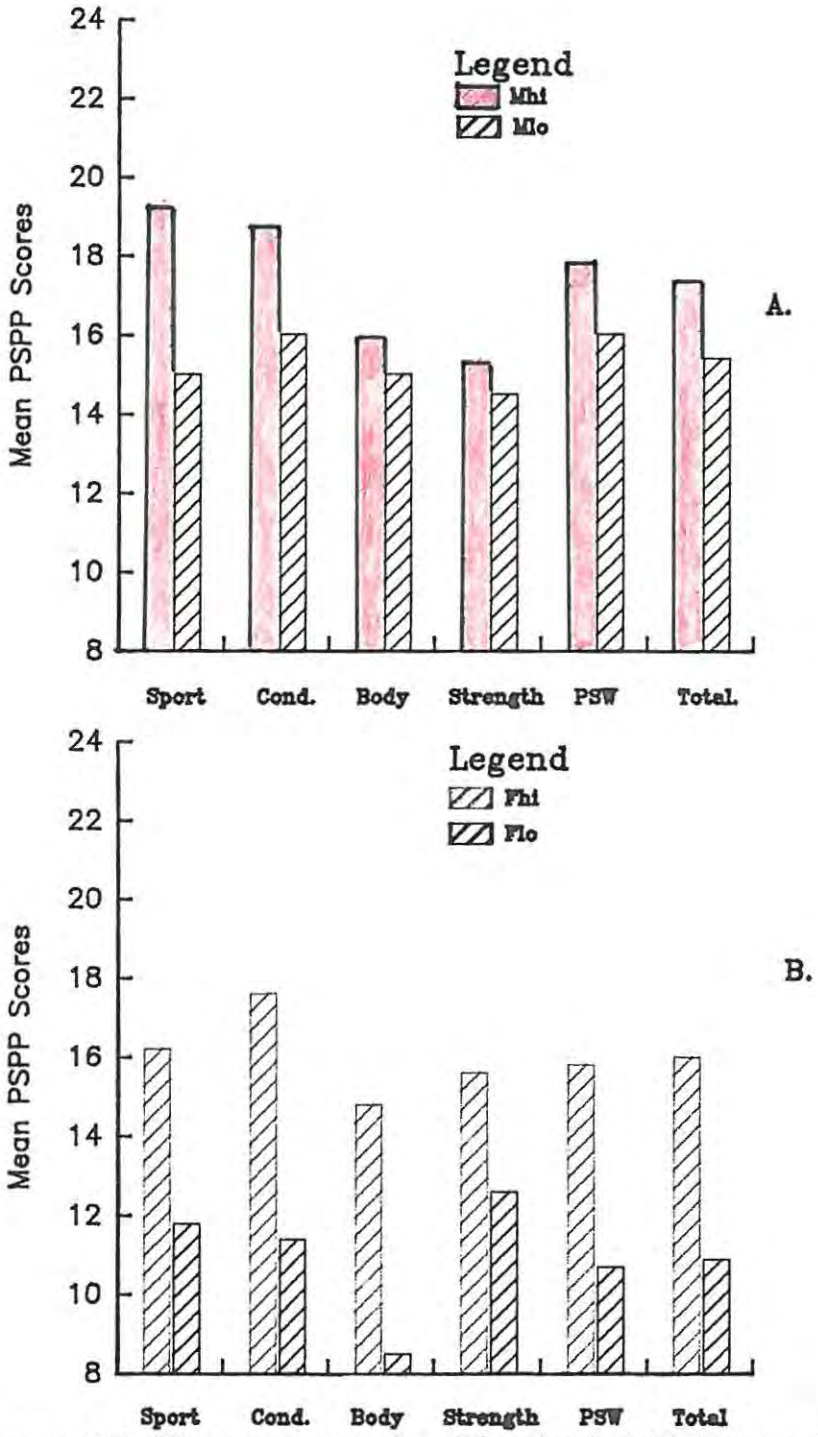


Figure 10. Mean Scores for Physical Self Perception Profile (PSPP) of (A.) Mhi and Mlo and (B.) Fhi and Flo.

A comparison of the results of high and low achievers, appears to be very much in accordance with the expectations of Fox and Corbin (1989) who indicate that their model has been successful in discriminating between high and low active individuals. This contention has been well supported in the present study with a significant difference existing between the scores of high and low achievers in every subscale of the PSPP (see Table VIII). Thus it would appear that high achievers, probably due to their success in traditional team sports, have a greater propensity and capacity to enjoy this experience (sport) and as a consequence are more likely to internalise beliefs and values, which in turn give them a higher sense of physical self-perception.

When comparing the PSPP results of the male high and low achievers, there appears to be a similarity in the trend identified with the CATPA inventory. That is, of all the groups examined these two groups (Mhi and Mlo) were characterised by the least difference in the various subscales. Although a significant difference does exist in Sport and Condition for Mhi and Mlo, the possible explanation for this lies in the inter-relation between the two subscales. The subscale Sport is an assessment of an individual's perception of his or hers sporting and athletic ability, along with the ability to learn sports skills and confidence in the sports environment. Condition is an assessment of the individual's perception of his or hers level of physical conditioning, stamina and

fitness, the ability to maintain exercise and confidence in the exercise and fitness setting. Mhi by virtue of their membership of first (elite) teams are placed in an environment where they are fully cognizant that their abilities in the sports domain are superior to Mlo. Such a perception of the physical self also infers that to achieve and maintain these superior standards a greater input must be made to physical conditioning. Thus according to the criteria of the subscale Condition, male high achievers would be more confident about their level of conditioning, take part more often in vigorous exercise and maintain a higher level of fitness and stamina than low achieving males. Interestingly the lack of differentiation between Mhi (16.0) and Mlo (15.0) in the subscale Body may be reflective of 'macho' male perceptions where, to be overly concerned with the way one looks physically, may be interpreted as being narcissic or feminine.

Comparing the results of the female high and low achievers, one is again reminded of the similarity in trends as shown in responses to the CATPA inventory, where the groups Fhi and Flo displayed the greatest divergence of scores. In the PSPP every subscale was characterised by a significant difference (see Figure 12b). Fhi, like Mhi, perceived of themselves being superior in both Sport and Condition, but the most striking margin of variance is displayed in the subscale Body. The responses reveal that the female low achiever perceive their bodies to be unattractive, feel embarrassed

wearing few clothes, do not receive admiration for the way they look, and feel self-conscious about the appearance of their bodies. Bearing in mind that Flo were characterised by a morphological profile that indicated that they were shorter, heavier and had a higher level of percentage body fat, it is not surprising that they have such a poor self-perception of their body, especially if one equates these factors in the context of societal expectations of the ideal female, who is invariably portrayed in the media as someone tall and slim (Tinning, 1991). This same group had a comparatively suppressed feeling of physical self-worth (PSW). These low PSW scores indicate that the female low achievers did not experience feelings of happiness, satisfaction, pride, respect and confidence in their physical self, a response that appears in varying positive modes for the other three groups. These findings are very much in accordance with the research conducted by Leary and Thanning (1990) on self-esteem and sport, who point out that where sporting achievement determines social standing, particularly in traditional school sport (in South Africa), fear of rejection by the peer group will generate anxiety and may lead to inappropriate acting out behaviour responses. This adoption of negative health behaviours, particularly reflected by the responses of the female low achievers may in turn may have important health implications in adulthood. In a review of 43 studies Powell (1988) concluded that there was without exception a positive

relationship in adults between a physically inactive lifestyle and incidence of CHD.

Ratings of Perceived Exertion (RPE)

Subjects were required to indicate the degree of breathlessness that they experienced during the shuttle run by referring to the Revised Borg Scale (1982) at the end of each level/minute of the MST. The ACSM (1986) consider that the Borg Scale is a well used and accepted method to evaluate subjective assessment of exercise intensity. They also go on to report that it correlates well with more objective measures of physiological function, including heart rate, respiratory changes and lactate metabolism.

The MST was developed by Leger *et al.* (1988) on the principle that after a starting speed of 8.5 km/hr an increase in running speed of 0.5 km/hr at the end of each minute/level would be the equivalent of an associated increase of 1 MET (Liu *et al.*, 1992). Clearly with each increase in running speed there will be an attendant increase on the demand of respiratory system to supply oxygen for the aerobic metabolism. In an effort to assess the individual's perceptions of these running demands utilisation of the perceptual cue of breathlessness was made.

It is evident from the data represented in Tables IX and X and the trends depicted in Figures 11ab and 12ab that the perception of effort as reported by subjective evaluation of

breathlessness induced by the MST at any given exercise intensity, was lower for males than for the female subjects, lower for high achievers as compared to low achievers, lower for Mhi than Mlo, and lower for Fhi when compared to Flo. The other consistent finding in the present study was that at the mean termination point in the MST, all groups indicated that they experienced a near maximal effort according to Borg's Revised Scale (1 - 10) where a rating of 7 is indicative of very strong demand on breathing and 10 is maximal; males (8.1), females (8.5), high achievers (8.0), low achievers (8.1), Mhi (8.9), Mlo (8.0), Fhi (8.5) and Flo (8.4). The contention that subjects consistently experienced maximal or near maximal effort is supported by the elevated heart rates recorded at the mean termination point. The relationship between the heart rate and RPE trends can be observed in Figures 13ab - 16ab. However it was not statistically feasible to run a correlational analysis between RPE and heart rate due the fact that heart rate was recorded and plotted as a linear function, where as breathlessness is characterised by an exponential function, and as a result was referenced with the revised Borg Scale which has ratio properties. The sex-related differences as exhibited by males and females in their RPE may be attributed to a number of factors. Firstly in terms of their morphology males were considerably taller than females and this difference in height may well be beneficial to males, enabling them to run the 20 m shuttle with fewer strides. In other words the females had to

run at a faster cadence to achieve the same running speed as males, and this increased cadence is likely to be reflected in females experiencing greater physiological strain, with an attendant increase in their perception of effort. Secondly the males had a lower percentage body fat than the females, which meant they were carrying less adipose tissue which is unproductive in terms of the aerobic metabolism; thus in a maximal test of aerobic capacity this 'additional' fat would have been inhibitative to the female subjects and they had to work harder to maintain the same speed as males. Thirdly an examination of heart rates revealed that the physiological strain experienced by males, compared to females was less for the males at every MST level and was probably indicative in part of the effects of both stature and percentage body fat. Finally if one assumes that the MST is perceived as a form of ascetic experience in an attitudinal sense, observation of the CATPA responses (particularly in the sub-domain Ascetic) indicated that the males were more positively orientated towards performing in a test that was physically arduous in its nature.

TABLE IX: Means and standard deviations (parenthesis) for RPE for Males, Females, High and Low achievers.

MST LEVEL	MALES	FEMALES	HIGH	LOW
1	0.98 (0.77)	1.23 (0.88)	0.86 (0.62)	1.34 (0.97)
2	1.64 (0.97)	2.26 (1.54)	1.57 (0.87)	2.33 (1.62)
3	2.14 (1.09)	3.19 (1.24)	2.34 (1.13)	2.99 (1.35)
4	2.74 (1.09)	4.09 (1.53)	2.87 (1.03)	3.97 (1.71)
5	3.31 (1.13)	5.21 (1.67)	3.58 (1.18)	4.93 (1.93)
6	4.06 (1.38)	6.62 (2.30)	4.24 (1.35)	6.44 (2.55)
7	4.84 (1.68)	7.32 (1.94)	5.36 (1.73)	6.80 (2.41)
8	5.80 (1.86)	8.08 (1.84)	6.43 (2.00)	7.46 (2.17)
9	6.70 (1.88)	8.79 (1.69)	7.31 (2.07)	8.18 (2.00)
10	7.25 (1.87)	8.92 (1.40)	7.65 (1.96)	7.70 (1.85)
11	7.73 (1.56)	8.50 (0.57)	7.81 (1.49)	7.81 (1.60)
12	8.61 (1.29)		8.42 (1.30)	9.12 (1.12)
13	9.53 (0.91)		9.58 (0.90)	9.33 (1.15)
14	10 (0.0)			

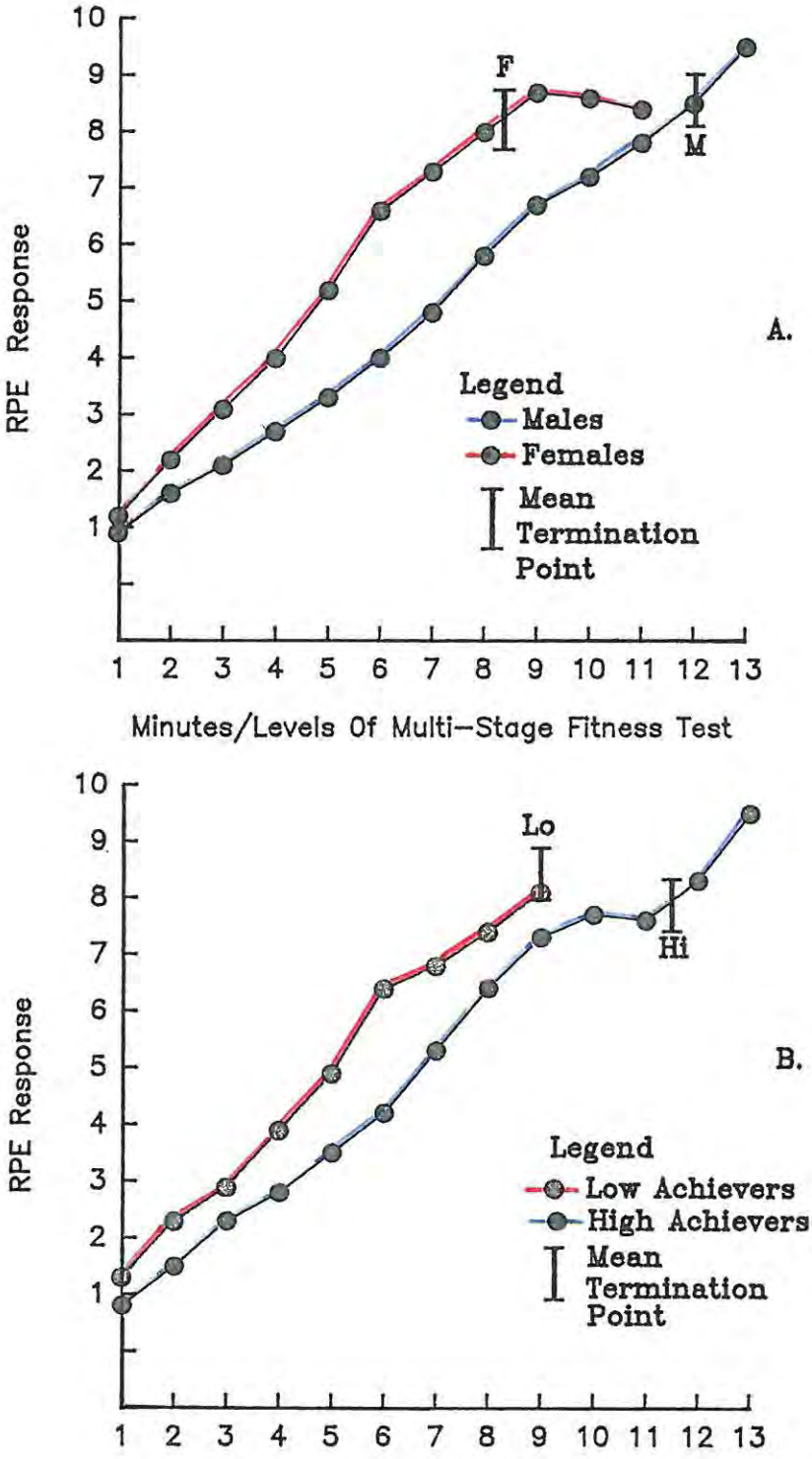


Figure 11. Mean RPE Scores for (A.) Males and Females; (B) High and Low Achievers.

TABLE X: Means and standard deviations (parenthesis) for RPE for male high achievers (Mhi), male low achievers (Mlo), female high achievers (Fhi) and female low achievers (Flo).

MST LEVEL	Mhi	Mlo	Fhi	Flo
1	0.64 (0.33)	1.31 (0.96)	1.08 (0.75)	1.37 (1.01)
2	1.35 (0.73)	1.93 (1.13)	1.80 (0.95)	2.72 (1.93)
3	1.83 (1.00)	2.45 (1.10)	2.86 (1.02)	3.52 (1.41)
4	2.37 (0.96)	3.12 (1.11)	3.37 (0.86)	4.81 (1.84)
5	3.00 (1.00)	3.62 (1.20)	4.17 (1.17)	6.25 (1.65)
6	3.62 (1.07)	4.50 (1.56)	4.86 (1.32)	8.38 (1.81)
7	4.51 (1.28)	5.16 (2.01)	6.20 (1.71)	8.44 (1.66)
8	5.44 (1.64)	6.17 (2.05)	7.42 (1.85)	8.75 (1.50)
9	6.03 (1.56)	7.36 (2.01)	8.58 (1.74)	9.00 (1.41)
10	6.96 (1.88)	7.70 (1.82)	8.92 (1.43)	
11	7.69 (1.57)	7.87 (1.60)	8.50 (0.57)	
12	8.38 (1.33)	9.12 (1.12)		
13	9.55 (0.90)	9.33 (1.15)		
14	10 (0.0)			

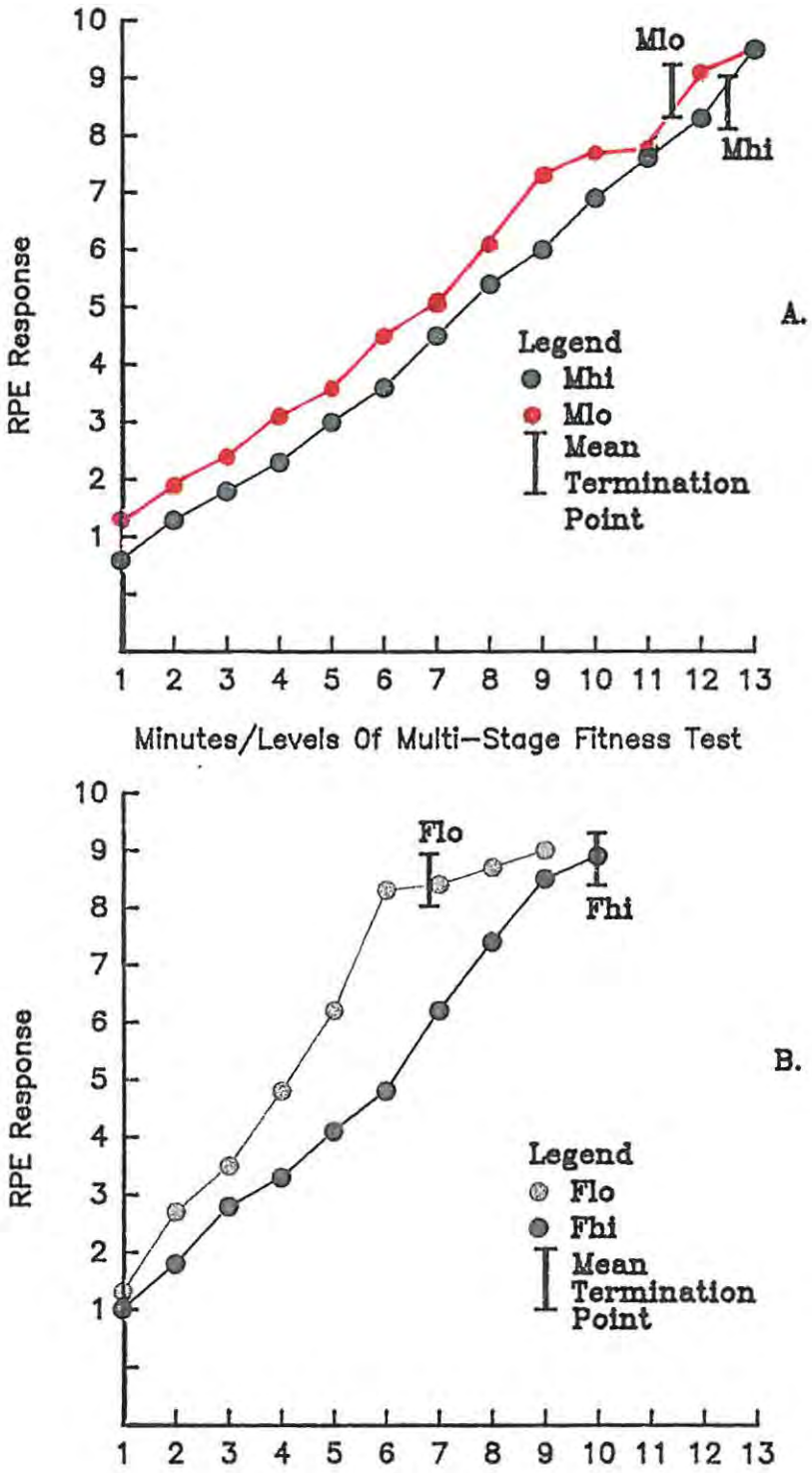


Figure 12. Mean RPE Scores of (A.) Mhi and Mlo and (B.) Fhi and Flo.

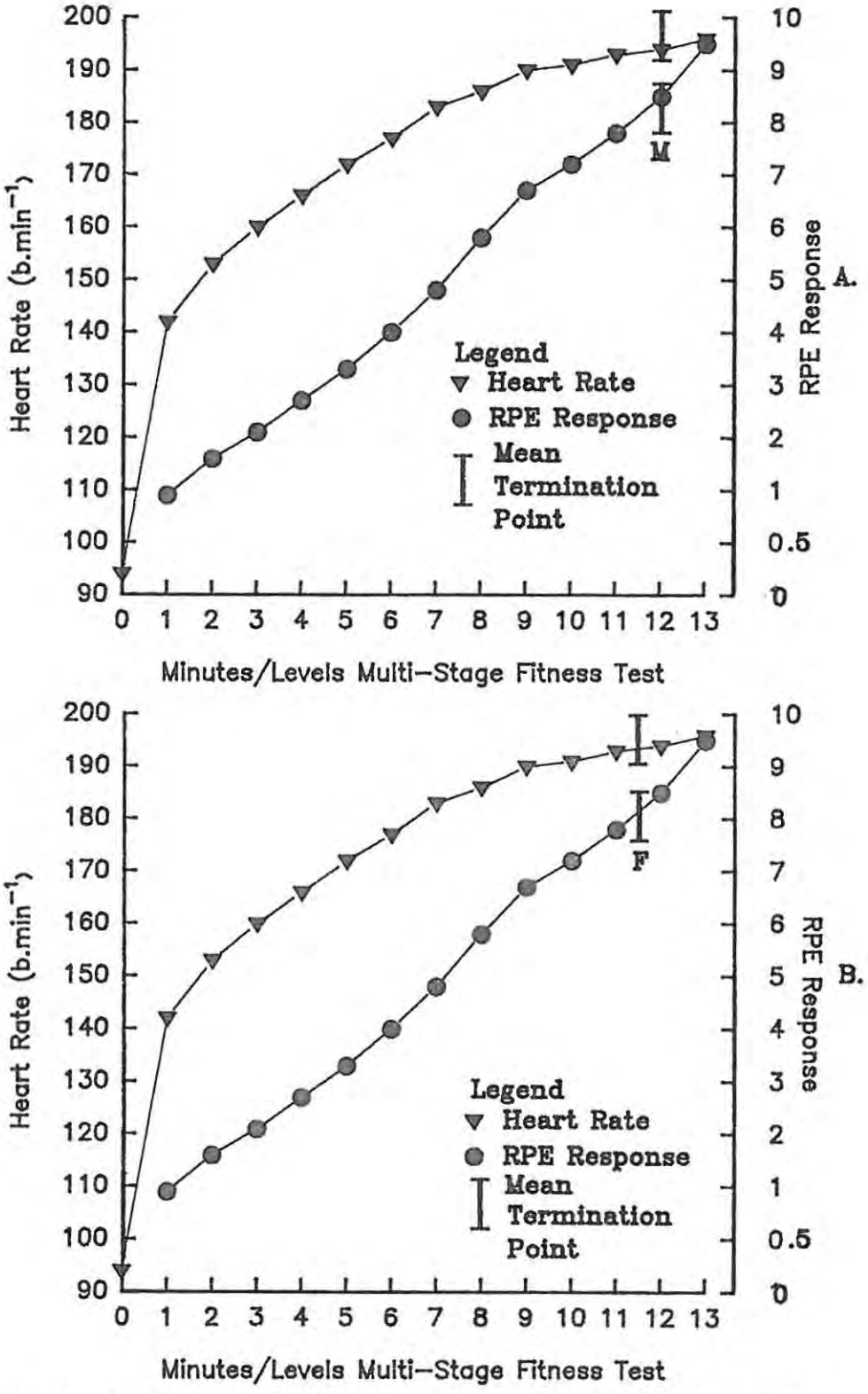


Figure 13. Mean Heart Rate and RPE Response for (A.) Males and (B.) Females.

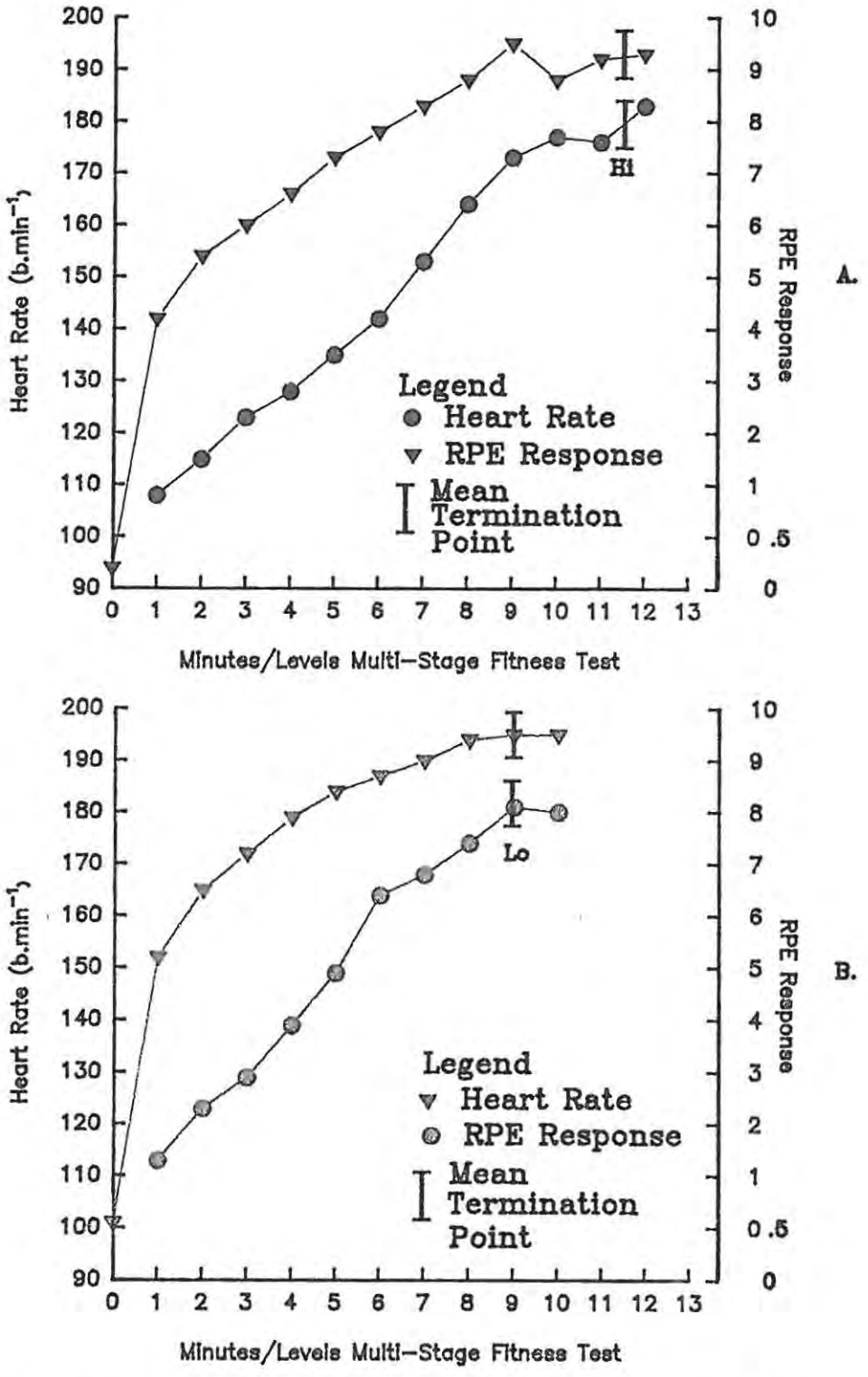
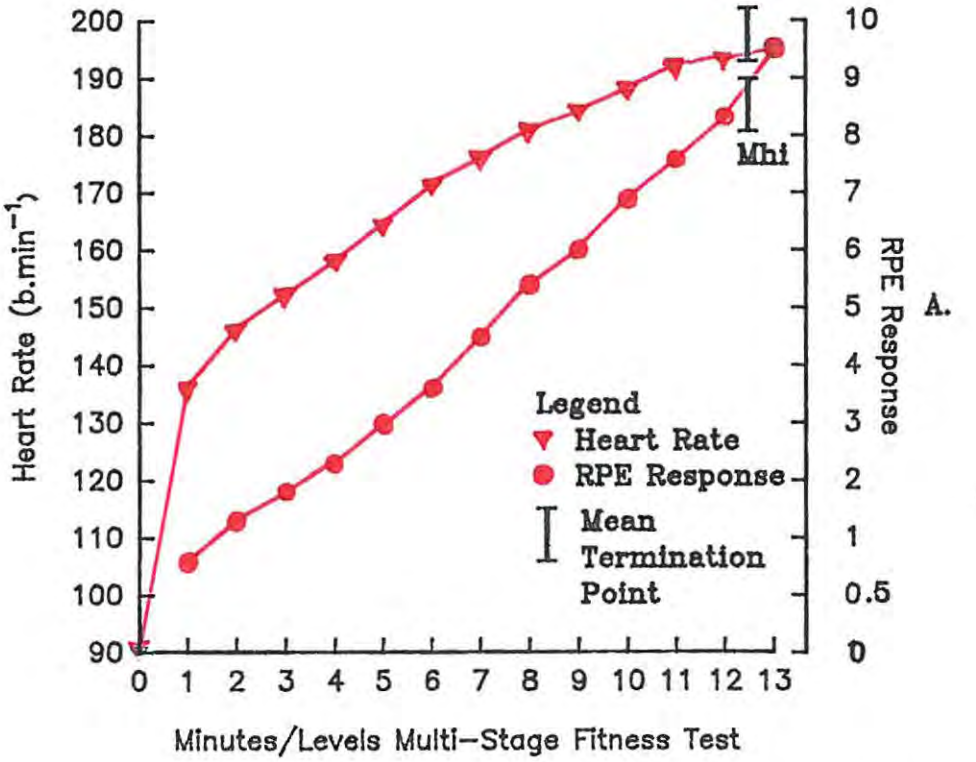


Figure 14. Mean Heart Rate and RPE Response for (A.) High and (B.) Low Achievers.



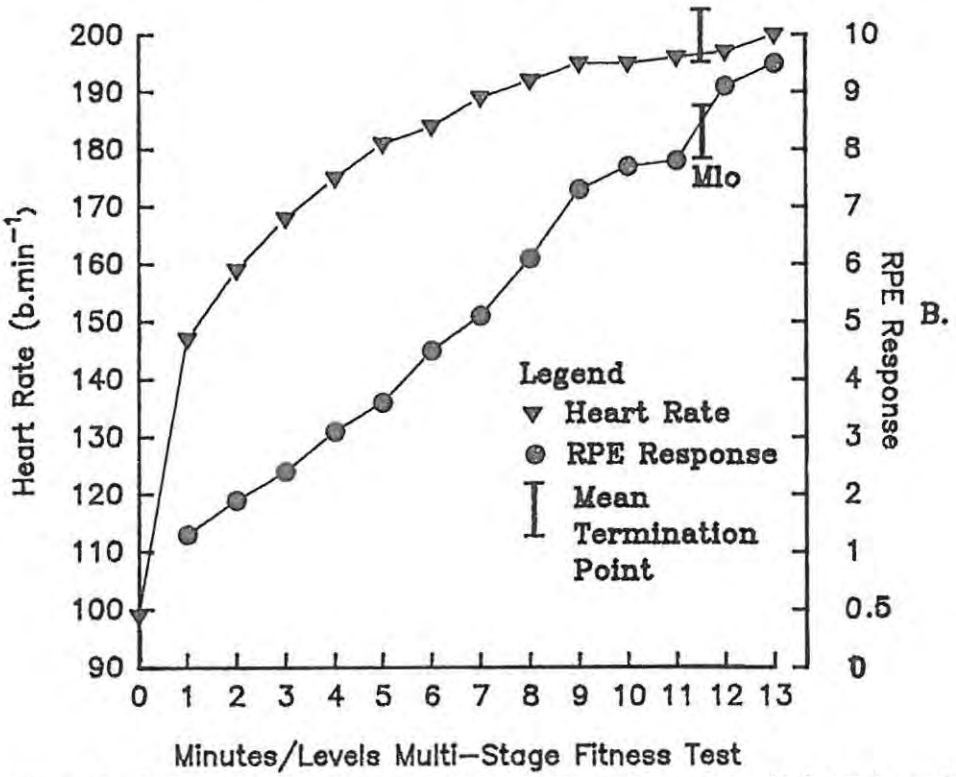
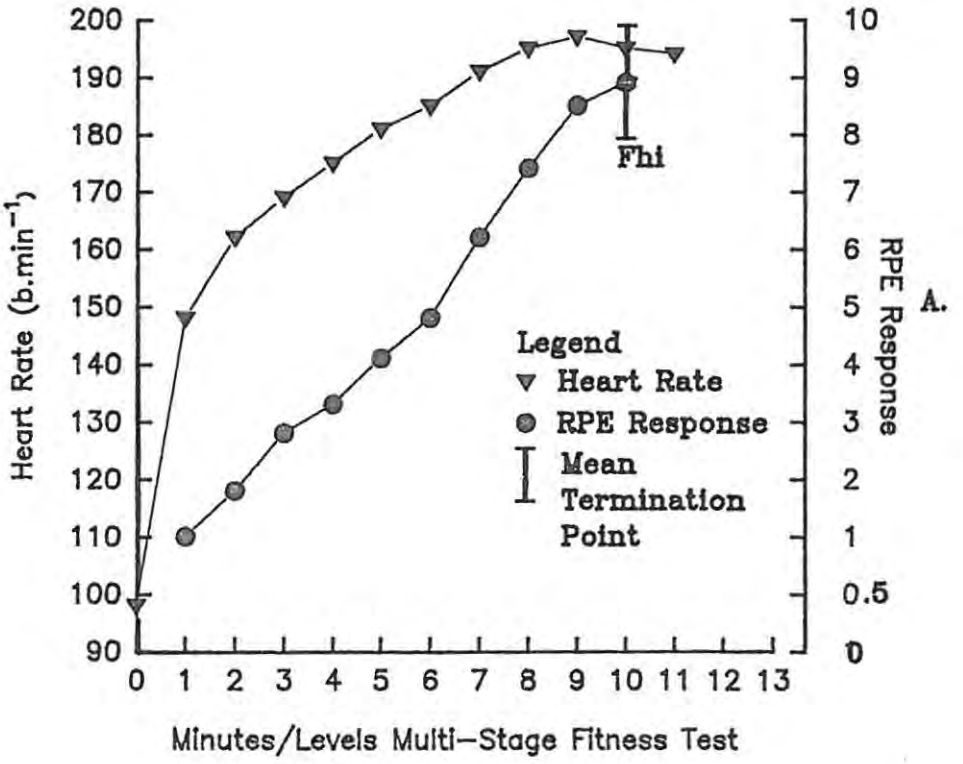


Figure 15. Mean Heart Rate and RPE Response for (A.) Mhi and (B.) Mlo.



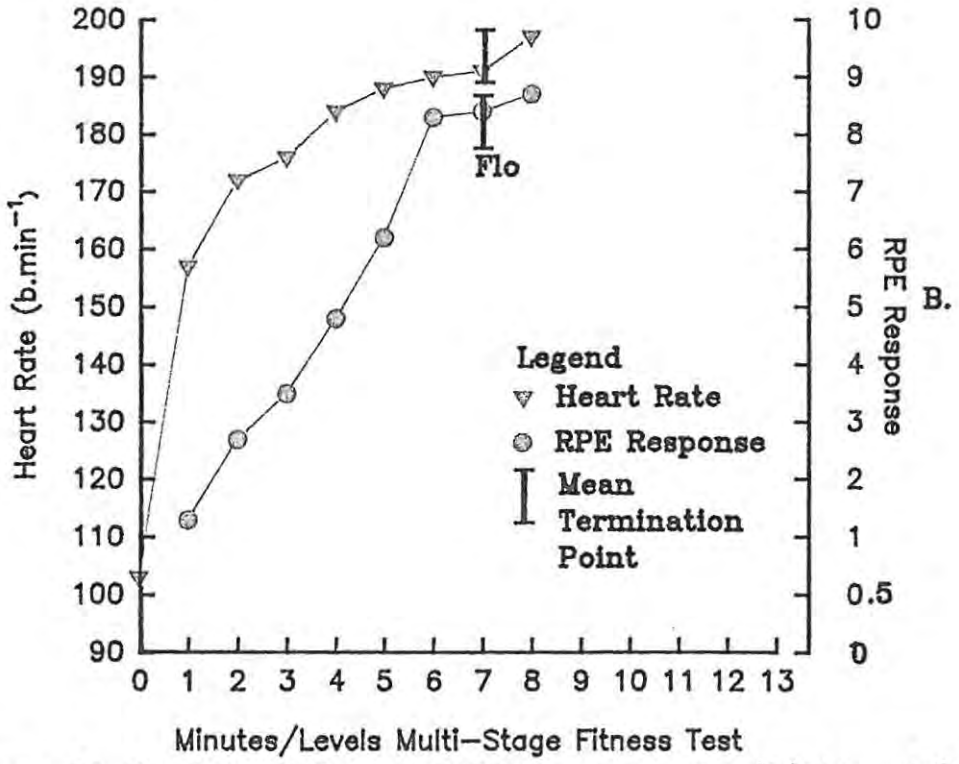


Figure 16. Mean Heart Rate and RPE Response for (A.)Fhi and (B.)Flo.

When comparing the RPE data of high and low achievers the trend that emerged was indicative of the fact that at any given level in the MST the high achievers reported a lower RPE. This may well be the result of the high achievers consistently performing at a higher level in traditional school sports, as well as being involved in regular practices and exercise training, which would result in them being better equipped, both physically and mentally, to endure a maximal test. Morgan (1981) stated that RPE involves both a cognitive (thinking) and perceptual (feeling) process. It is therefore likely, given the criteria on which this present sample was based, that high achievers, as a result of their positive experiences of traditional school sport, are more cognizant of what is expected during an exercise episode and are more inclined to perceive that the feelings associated with physical exertion are beneficial and generally good for them even if the effort demand is high. The male high and low achievers displayed the least difference in their RPE scores when compared to all other paired group analyses. Although Mhi indicated that their perception of breathlessness was marginally less at any given level in the MST than Mlo the variance was minimal and was in fact substantially less than in other group comparisons. It has been suggested in previous studies Mihevic (1981) that sometimes in a test situation, especially if it is seen to be competitive, subjects will have a tendency to suppress their RPE. However in an attempt to lessen the chances of inter-group

comparison and potential RPE suppression in this study, subjects had to call their RPE at the same time, thus minimising the chance of individuals making evaluative changes based on the RPE responses given by their compatriots.

It is clear that although differences do exist in the male high and low achieving groups with respect to their anthropometric, physiological and psychological responses, these differences are less than between the other groups. Mhi were selected essentially on the criteria that they were an elite group in terms of performance in traditional school sports. Yet the comparative indifferent margin between the two groups possibly reflects that the emphasis on traditional school sports does not appear to overly alienate Mlo nor affect their physical performance or their RPE responses.

The results of female high and low achievers reveals the elevated RPE of Flo compared to Fhi, and all other groups. Flo reported an initial RPE that was higher, and the increase in the trend as depicted in Figure 12b is also more rapid and exponential, than recorded for all other groups. Not only do Flo have the most undesirable morphological characteristics for participation in traditional school sports, but their heart rates are indicative of greater physiological strain; and furthermore psychologically they were the most negatively orientated. This combination would appear to contribute to Flo perceiving the exertion required to run at each level in the MST as being more arduous than any other group examined.

GENERAL DISCUSSION

A general overview of the results produced in this study would seem to indicate that each group was characterised by its fairly distinctive and coherent scores and responses. Furthermore, by employing an holistic approach, the present study was conceptually better prepared to examine the resultant diverse data and evaluate the nature of the interrelationships contained therein. The benefits of an holistic perspective are perhaps most revealing when one examines some of the individual anomalies that were exhibited by some of the subjects. It should be reiterated at this juncture that the criterion by which the subjects were divided was based on their level of participation in traditional school sports. Furthermore when the psychometric inventories were presented to the subjects, they were asked to answer the questions specifically in the context of traditional school sports.

Examples of incongruent results occurred largely when individuals who were classified as a low achievers (Mlo or Flo) in traditional school sports such as rugby and cricket for males, and hockey and tennis for females, were in fact high achievers in other sporting activities which they often pursued outside of the school regime. This was well illustrated by a number of subjects who were classified as low achievers, but were in fact successful members of the local road running club. It was of particular interest that these subjects ran a relatively high number of shuttles in the MST indicating a high

VO_2 max, but responded often quite negatively in the psychological domain. This example demonstrates that the experience these individuals encounter in the traditional school sports environment is largely an adverse one, perhaps compounded by their small size, and a lack of overt competitiveness and aggressiveness that is often expected of high achievers in traditional team sport, and that their personal enjoyment and participation in physical activity has as a consequence, developed outside of the school system. The emphasis on inter school competition may well be a primary factor in individual alienation from participation in the school sports programme and previous studies which support the notion that a relationship exists between competition and discontinuation include Orlick (1974) and Gould *et al.* (1982). Conversely, there were a number of subjects who were classified as high achievers (Mhi and Fhi) characterised by desirable morphological and physiological attributes for their traditional sporting disciplines, but were low scorers in the psychological domain. This perhaps indicates that these individuals were not intrinsically orientated (psychologically) towards participation at first team level and were subjected to the powerful cultural, societal and parental expectations, resulting in them having little choice but to play the traditional sports at this standard. In a review on the effects of over competitiveness in youth sport LeUnes and Nation (1990) argue that games should be orientated philosophically

toward making sport physically healthy and psychologically rewarding, rather than as a means for parents (or teachers) to live out their lives vicariously through their children. Therefore the individual whose physical attributes predispose them towards traditional school sports will often be under greater pressure and expectation to achieve these levels of performance, even though it would appear that sometimes little regard is given as to how children feel and perceive their role in competitive participation.

The view that regular physical activity is a primary factor in the promotion of good health, has been expressed by the likes of Aristotle (Rice *et al.*, 1969), and in more recent times by scientists and medical experts (Bouchard *et al.*, 1990). This study concerned itself with the lifestyle orientations of 16 - 18 year olds, and it is clear that in the context of traditional school sport the difference between male high and low achievers in their general responses was relatively small in comparison to female high and low achievers. It should be noted that the disparity between Fhi and Flo is largely as a result of Flo recording considerably more undesirable and negative responses in almost every aspect of this study. According to Leary and Thanning (1990) the present emphasis on traditional sports in South African schools does little in the way of promoting a physically active lifestyle orientation in female low achievers. Bar Or (1990) makes the point that the school is the best possible place for the development of positive exercise behaviours. Unfortunately

this does not appear to be a major objective in South African schools and according to Loper *et al.* (1989) given the importance accrued to traditional sports, and the pressure of coaching winning teams, it is less likely that Physical Education teachers will be concerned with producing positive health outcomes in their pupils.

It is therefore apparent that traditional school sport does little to promote positive and active lifestyles in those females construed as low achievers. A more specific analysis of the data reveals that the female low achievers emerged as a group who are characterised by the most undesirable morphological and physiological measures, along with a psychological profile that is more negatively orientated than any other group. It is tentatively suggested that gender expectations appear to have a powerful influence over both the degree to which females participate in sport and the way in which they experience it. The powerful influence of societal and cultural expectations of the role of women in sport is indicated by Bryson (1990) who states that only certain well defined sports are socially acceptable. Although Lirgg (1991) points to the increasing opportunities for girls and women in sport, it is important to note that according to LeUnes and Nation (1990) that it has only become recently acceptable for women to compete in sports, though this acceptability is hardly universal. This selective acceptability is apparent in the observations made by Lipsyte (1975) who notes that sports is a

male sanctuary, therefore any woman who tries to invade is "not really a woman"(p.217). Bearing in mind these factors, it is evident that female participation in sport is complicated by societal expectations, not only as to what sports are acceptable, but also with the retention of feminine like behaviour. Finally, as sports are clearly a manifestation of human movement, then the perception of the physical self during such activity takes on considerable importance. With reference to the present selection of female subjects it is most apparent that they were very much concerned with their physical appearance, as reflected very clearly in their responses to the PSPP inventory regarding Body Image. If a female falls outside of societal and cultural norms regarding her physique, which is very specific and entails being tall and slim according to Tinning (1991), then it is quite likely that they will feel embarrassed and out of place in a sporting situation, especially if they have to wear sports uniforms that tend to reveal the body rather than hide it. With regard to the present female sample it would partially explain the negative psychological profile of Flo, because they were the shortest, and heaviest group, with the highest percent body fat. Interestingly Fhi also exhibited a suppressed Body Image score in the PSPP indicating that this group are less than happy with the way they look, and is perhaps a reflection of this groups' perception that they have a physique which falls outside societal and cultural norms (Franck, 1984). Secondly with

particular reference to the female low achiever it is suggested that to be successful in traditional school sports requires a competitive attitude because winning is an important component of inter school matches. It may well be that for Flo to adopt a competitive approach along with their low body image, may in a sense, reinforce their fear of being construed as someone who is not feminine. This is because females often perceive that a successful competitive attitude in sport is more easily equated as an aspect of male behaviour. In other words if Flo believe that they do not look like the ideal woman then they can at least behave like one.

It is clear that in the present study that although differences do exist between male high and low achievers, the degree of difference between female high and low achievers is far more dramatic, largely due to the aberrant negativity displayed in the scores and responses of Flo in almost every variable analyzed.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

AIMS OF THE STUDY

In view of the comparative absence of research investigating sporting and exercise behaviour in children (Gould et al., 1982; Dishman and Dunn 1988), this study has sought to examine the lifestyle orientations of high and low achievers in traditional school sport. An holistic approach as advocated by Charteris *et al.* (1976) was employed in the present study embracing anthropometric, physiological, and psychological parameters. It is the contention of this study that an holistic approach better equips the researcher with a methodological model to elucidate the nature of the relationships which characterise lifestyle orientations of high and low achievers in traditional school sport.

The questions addressed, aimed firstly at determining whether or not there were significant differences between the paired groupings; males and females, high and low achievers, male high achievers (Mhi) and male low achievers (Mlo), and female high (Fhi) and low achievers (Flo) in respect of their morphological, physiological, and psychological responses.

METHODS

One hundred and four subjects volunteered to participate in this study (mean age 16.71, SD 0.63), of this total 51 were males and 53 were females. The subjects were then categorised according to their level of participation in traditional school sports. The breakdown of the groups was as follows:

High Achievers = males + females

Low Achievers = males + females

Mhi = male high achievers

Mlo = male low achievers

Fhi = female high achievers

Flo = female low achievers

Each subject was assessed in the following tests to ascertain whether or not any significant differences were apparent between the paired group analyses. These tests entailed in the anthropometric domain, the measurement of stature, mass, percentage body fat, and WHR.

Physiological assessment entailed the prediction of VO_2 max by means of the MST, and the assessment of physiological strain by minute by minute heart rate monitoring during this test, along with a reference (pre-exercise) heart rate.

The psychological domain was assessed by the utilisation of CATPA to elicit attitudinal responses to physical activity and PSPP to present an understanding of the physical self. Finally Borg's revised RPE scale with ratio properties was used to measure the degree of breathlessness as indicated by the

subjects at the end of each level/minute during their participation of the MST until they voluntarily withdrew.

The results were analyzed by single variable statistics, Analysis of Variance Tests. A 0.05 level of probability was chosen.

RESULTS

This study produced anthropometric results illustrating that significant differences exist between the male and female subjects in their morphological composition, the males were taller and heavier, and exhibited a higher WHR. Females on the other hand were higher in percentage body fat. This finding is commensurate with previous research investigating sex-related morphological differences (Behnke and Wilmore, 1974; Wilmore, 1983; Gordon and Gibbons, 1991).

High achievers as a whole group were significantly taller and lower in percentage body fat as compared to low achievers.

Interestingly Mhi and Mlo were not significantly different in any of the anthropometric measures, while Fhi were significantly taller, lighter, and lower in percentage body fat, along with a higher WHR than Flo. These results are perhaps an indication that school sport differentiates between high and low achievers possibly as a result of their morphology and genetic predisposition as postulated by Noakes (1992).

The MST was employed as a validated method to provide an accurate prediction of maximal aerobic capacity (VO_2 max) (Liu

et al., 1992). The results of the present study indicate that VO_2 max was higher in males than females, higher in high achievers than low achievers, higher in Mhi than Mlo, and higher in Fhi than Flo. Although the differences between the paired groupings were all significant it was interesting to note that the disparity between Fhi and Flo was comparatively more pronounced, than that shown by Mhi and Mlo.

Physiological strain was assessed by minute by minute monitoring of heart rate at the end of each level of the MST, up until the subject voluntarily withdrew from the test. Congruent with previous reports including McArdle *et al.* (1986) the present study identified that at any given exercise intensity as induced by the MST, males experienced a lower degree of physiological strain than females, this response was also lower for high achievers than for low achievers, lower for Mhi than Mlo, and lower for Fhi than Flo. The same trends were evident in the data regarding the pre-exercise (reference) heart rate.

Two psychometric inventories were utilised to provide data regarding the psychological domain. The CATPA inventory was employed to elicit the differing attitudes that the subjects held towards physical activity. The highest composite total score was provided by Fhi (45.6), and then followed by the groups in descending score order; the total group of high achievers (43.0), Mhi (40.41), female group as a whole (37.7), all male subjects (36.6), Mlo (32.8), and Flo (29.8). In terms

of a total composite score there appeared to be no significant difference between males and females. However, females scored significantly higher in the subdomains Social Growth and Aesthetic, while males scored higher in Vertigo.

High achievers were characterised by a significantly higher total composite score, and more specifically high achievers scored higher than low achievers in the sub-domains of Social Growth, Social Continuation, Health and Fitness, Vertigo and Ascetic.

Mhi and Mlo were most conspicuous for their lack of variance, with Mhi scoring significantly higher only in the sub-domain of Vertigo. Fhi scored significantly higher than Flo not only in their total composite score, but also in the sub-domains of Social Continuation, Health and Fitness, Vertigo, Catharsis, and Ascetic. It was also interesting to note that the highest total score was provided by Fhi (45.6) and the lowest Flo (29.8).

The application of the PSPP provided an insight into the perception of the physical self. Consistent with the expectations of the authors of the PSPP, Fox and Corbin (1989), the present study was also successful in identifying differences in the components that form the concept of the physical self in relation to sex and level of achievement. The highest total composite score was recorded by Mhi (87.4) followed by high achievers (83.9), the male subjects (82.2), Fhi (80.4), Mlo (77.1), the total female group (67.7), low

achievers as a whole (66.0) and Flo (54.9). When comparing sex-related responses one observes that males scored significantly higher than females in the total composite score, and more specifically in the subscales Sport, Condition, Body, and Physical Self-Worth (PSW).

High achievers respond in a more positive fashion than low achievers in their total composite score, as well as in the subscales; Sport, Condition, Body, Strength, and PSW.

Mhi recorded the highest total composite score (87.4) and scored significantly higher than Mlo in two of the subscales Sport and Condition. Fhi and Flo display the greatest divergence of all groups examined, this can be largely attributed to the low scoring responses of Flo whose total composite score of (54.9) was the lowest. Fhi recorded a significantly higher score than Flo in all the subscales; Sport, Condition, Body, Strength, and PSW.

At the end of each level/minute of the MST the subjects indicated their perception of breathlessness using Borg's revised scale (1982). It is clear from the data that at any given exercise intensity as induced by the MST, the perception of effort (ascertained by the physiological cue of breathlessness) was lower for males than females, lower for high achievers than low achievers, lower for Mhi than Mlo, and lower for Fhi than Flo. These findings are in accordance with the findings of previous studies investigating perception of effort, most notably the reviews by Mihevic (1981) and Carton

and Rhodes (1985) who indicate that both males and those individuals who have higher levels of training experience (high achievers) tend to rate their perception of effort lower than their respective counterparts females and those who have lower levels of training experience (low achievers).

CONCLUSIONS

1. No significant differences were found between any of the anthropometric measures of Mhi and Mlo. Fhi and Flo however were significantly different in their stature, mass, and percentage body fat.

2. VO_2 max was higher for males compared to females, higher for high achievers compared to low achievers, higher for Mhi compared to Mlo, and higher for Fhi compared to Flo.

3. The physiological strain (assessed by heart rate responses) experienced by the subjects at any given level of the MST was lower for males than females, lower for high achievers than low achievers, lower for Mhi than Mlo, and lower for Fhi than Flo. Reference (pre-exercise) heart rate followed this same trend.

4. In terms of the total score accrued in the CATPA inventory, the group who were most positively orientated towards physical activity were Fhi (45.6), followed by Mhi (40.4), Mlo (32.8), and the least positive Flo (29.8). Mhi were characterised by a significantly higher score than Mlo in the subdomain of Vertigo only, where as Fhi scored significantly higher than Flo in five of the subdomains; Social Continuation, Health and Fitness, Vertigo, Catharsis, and Ascetic.

5. The total of response scores from the PSPP inventory suggest that Mhi (87.4) have a perception of their overall physical self that is the most positive, followed by Fhi (80.4), Mlo (77.1), and the lowest Flo (54.9). Mhi score significantly higher than Mlo in two of the subscales Sport and Condition, while Fhi score significantly higher than Flo in every subscale; Sport, Condition, Body, Strength, and PSW.

6. The use of Borg's revised RPE scale (1982) revealed that the perception of effort as indicated by the physiological cue breathlessness was, for any given level of the MST, lower for males compared to females, lower for high achievers compared to low achievers, lower for Mhi compared to Mlo, and lower for Fhi compared to Flo.

In light of the these results the following conclusions can be drawn:

Hypothesis One : A rejection of the null hypothesis.

The findings of this study lead one to tentatively accept the Alternative Hypothesis as follows : that there is a difference between males and females with regard to their:

a) anthropometric measures; stature, mass, percentage body fat and WHR.

b) physiological responses; predicted VO_2 max, and physiological strain as measured at each level of the MST by minute by minute monitoring of heart rate. Reference (pre-exercise) heart rate.

c) psychological responses; CATPA in the sub-domains Social Growth, Vertigo, and Aesthetic. PSPP in total composite score, and more specifically in the subscales Sport, Condition, Body, and PSW. In RPE females responded with a more elevated rating than males at every level of the MST.

Hypothesis Two : A rejection of the null hypothesis.

The findings of this study lead one to tentatively accept the Alternative Hypothesis as follows : that there is a difference between high and low achievers with regard to their:

a) anthropometric measures; stature and percentage body fat.

b) physiological responses; predicted VO_2 max, and physiological strain as measured at each level of the MST by minute by minute monitoring of heart rate; and Reference (pre-

exercise) heart rate.

c) psychological responses; CATPA in total composite score, and more specifically in the sub-domains Social Growth, Social Continuation, Health and Fitness, Vertigo and Ascetic. PSPP in total composite score, and more specifically in all the subscales Sport, Condition, Body, Strength, and PSW.
In RPE low achievers responded with a more elevated rating than high achievers at every level of the MST.

Hypothesis Three : A rejection of the null hypothesis.

The findings of this study lead one to tentatively accept the Alternative Hypothesis as follows: that there is a difference between male high achievers and male low achievers with regard to their:

b) physiological responses; predicted VO_2 max, and physiological strain as measured at each level of the MST by minute by minute monitoring of heart rate.

c) psychological responses; CATPA, only in the sub-domain Vertigo. PSPP in total composite score, and more specifically in the subscales Sport and Condition. In RPE Mlo responded with a more elevated rating than Mhi at every level of the MST.

Hypothesis Four : A rejection of the null hypothesis.

The findings of this study lead one to tentatively to accept the Alternative hypothesis as follows: that there is a difference between female high achievers and female low achievers with regard to their:

a) anthropometric measures; stature, mass, and percentage

body fat.

b) physiological responses; predicted VO_2 max, and physiological strain as measured at each level of the MST by minute by minute monitoring of heart rate.

c) psychological responses; CATPA in total composite score, and more specifically in the sub-domains Social Continuation, Health and Fitness, Vertigo, Catharsis, and Ascetic. PSPP in total composite score, and more specifically in all the subscales Sport, Condition, Body, Strength, and PSW. In RPE Flo responded with a more elevated rating than Fhi at every level of the MST.

RECOMMENDATIONS

The present study by virtue of an holistic approach appears to have been largely successful in presenting a more enlightened and informed understanding of those factors and inter-relationships that characterise high and low achievers, whether male or female, in traditional school sports. However, due to logistical constraints experienced in the present study, such as geographic location, demographic composition of the schools examined, and not least a limit on time, it is suggested that the following recommendations for future research be considered.

1. During the present study only subjects in the age range 16 - 18 years were assessed. It may be necessary to assess other age groups to provide a fuller understanding of physical lifestyle orientation, with particular respect to:

a) The transition from standard 5 to standard 6.

b) The period prior, during and after puberty.

c) The transition from school to work, university or post school life.

2. The present sample was largely comprised of white subjects. It is suggested that further studies in this research area should also identify other ethnic groups (Black, Coloured and Asian) within the South African population.

3. Further research needs to examine the influence of extra-curricular (outside of school time and control) sports and physical activities, on the physical lifestyle orientation of the pupils.

4. It is clear from the present study that the group of female low achievers (Flo) were significantly different in almost all respects to the other groups examined. It is suggested that in order to provide a clearer explanation of why this group exhibit such a negative physical lifestyle orientation, that a more sociological approach be developed, and more specifically from a critical feminist perspective.

5. Bearing in mind that South African females have the highest incidence of CHD in the world (Simons, 1986) and that there is an established association between lack of exercise and CHD (Powell, 1987), it is suggested that future studies should examine whether or not the emphasis on traditional school sports, instead of more health related objectives in the Physical Education curriculum, may be linked to low levels of exercise compliance in the female adult population.

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LIFESTYLE ORIENTATION OF HIGH VERSUS LOW ACHIEVERS IN TRADITIONAL SCHOOL SPORTS : A HOLISTIC ANALYSIS

The above is the title of my Masters Research Project at Rhodes University. There is a substantial volume of literature which indicates that a physically active lifestyle is a most important precursor for good health and well-being. However it would appear that many children are in fact inclined to be physically inactive. It is also reported that if a sedentary lifestyle orientation is established during childhood, it is very likely to be a characteristic of adulthood, and places this group of people at a far higher risk to chronic diseases associated with an inactive lifestyle.

It is therefore the aim of this project to investigate the nature of the attitudes and perceptions of high and low achievers in traditional school sports, and to examine whether or not this has any influence on their level of achievement; as well as to establish whether or not this affects their general involvement in physical activity.

As this project is undertaken with a view to it making a valuable contribution to understanding why children are physically inactive, I would like to include 16-18 year-old male/females who can be identified as either high or low achievers in traditional school sports.

Due to the multi-faceted nature of this study, subjects will be obliged to participate in three testing sessions. During the first session, general demographic and base-line data will be collected. The base-line data includes age and sex of the

subjects and their present involvement in physical activity. At this session they will be required to complete two questionnaires, the Physical Self-Perception Profile and the Children's Attitudes Towards Physical Activity. The first session will last 45 minutes and will entail the subjects as a whole group being present at one time.

The second session involves anthropometric measurement, which will include stature and mass, four skinfolds and circumference of waist and hip. The second session will last 10 minutes working with 2 to 3 subjects at a time.

The third session involves measurement of physiological and perceptual parameters including the Multi-Stage fitness test for the prediction of maximum oxygen uptake along with continuous heart rate monitoring and ratings of perceived exertion using the Borg Scale. The third session will last 30 minutes working in groups of 5.

In order to make the study viable it is hoped to have approximately 100 children participate in the study.

Individuals and/or schools interested in the results of the study will be furnished with the relevant infomation on completion of the project.

SUBJECT CONSENT FORM

I, _____, having been fully informed of the nature of the research entitled:
LIFESTYLE ORIENTATION OF HIGH VERSUS LOW ACHIEVERS IN TRADITIONAL SCHOOL SPORTS : AN HOLISTIC ANALYSIS.

I am fully aware of the methods entailed as well as the potential risks and benefits attendant to my partaking as explained to me verbally and in writing. In agreeing to be a participant in this research, I waive any legal recourse against the researchers or Rhodes University, from any and all claims resulting from personal injuries endured. This waiver shall be binding upon my heirs and personal representatives. I am aware that it is essential for me to report immediately to the researcher any signs or symptoms indicating any abnormality or distress.

I am aware that I may withdraw from my involvement in the research at any time. I am aware that my anonymity will be preserved at all times, and agree that the information collect may be used and published for statistical or scientific purposes.

I have read the information sheet appended to this form and understand it. Any questions which may have occurred to me have been answered to my satisfaction.

SUBJECT (OR LEGAL REPRESENTATIVE)

_____ _____ _____
(PRINT NAME) (SIGNED) (DATE)

PERSON ADMINISTERING INFORMED CONSENT

_____ _____ _____
(PRINT NAME) (SIGNED) (DATE)

WITNESS:

_____ _____

ANTHROPOMETRIC MEASURES

NAME

SCHOOL

D.O.B. / /

STANDARD

SEX MALE / FEMALE

CODE

STATURE AND MASS

STATURE

MASS

WAIST - TO - HIP RATIO (WHR)

WAIST

HIP

WH. RATIO

RISK

SKINFOLDS (SF)

TRICEP SF

BICEP SF

ILIAC SF

SCAPULAR SF

SUM OF SF

% BODY FAT

- BODY COMPOSITION BY SKINFOLDS -

Subject Name/Code : MALE3

Age (yrs) : 17 Nude dry Mass (kg) : 70.3 Method : Durnin & Womersley :
Sex : M Body Surface Area (m²) : 1.874
Stature (cm) : 173 Body Density (kg/l) : 1.06085

Biceps : 3.9 (mm)
Triceps : 9.2 (mm)
Subscapular : 8.3 (mm)
Supra Iliac : 7.6 (mm)

BODY COMPOSITION ESTIMATES

FAT MASS						LEAN MASS	
Total		Essential		Non-Essential		LBM	
(%)	(kg)	(%)	(kg)	(%)	(kg)	(%)	(kg)
16.57	11.64	3.00	3.11	13.87	9.75	83.13	58.44

NORMATIVE ANALYSIS (young adults)

Body Dens (kg/l)	1.08791	1.07608	1.06451	1.05319	1.04210	1.03125
Fat Mass % 3	5	10	15	20	25	30

CAUTION | Subject is MALE | CAUTION

UNDERWEIGHT | LEAN | NORMAL | OVERFAT | OBESE ----) BOW

Total fat %

CAUTION | FEMALE | CAUTION

Fat Mass % 12	15	20	25	30	35	40
Body Dens (kg/l)	1.08791	1.07608	1.06451	1.05319	1.04210	1.03125

SUBJECT'S RATING

Relative to the value judgement you are neither over- nor underweight. But NOTE : "Desirable mass" does not necessarily imply that the COMPONENTS of that mass are what they should be.

NB : Age related norms ex Pollock et al., 1984: (Tables A-1 to A-10). These are American norms.
Technique after McArdle et. al., 1986.
Body density from Durnin and Womersley, 1974.
%Fat equations follow Siri, 1961.

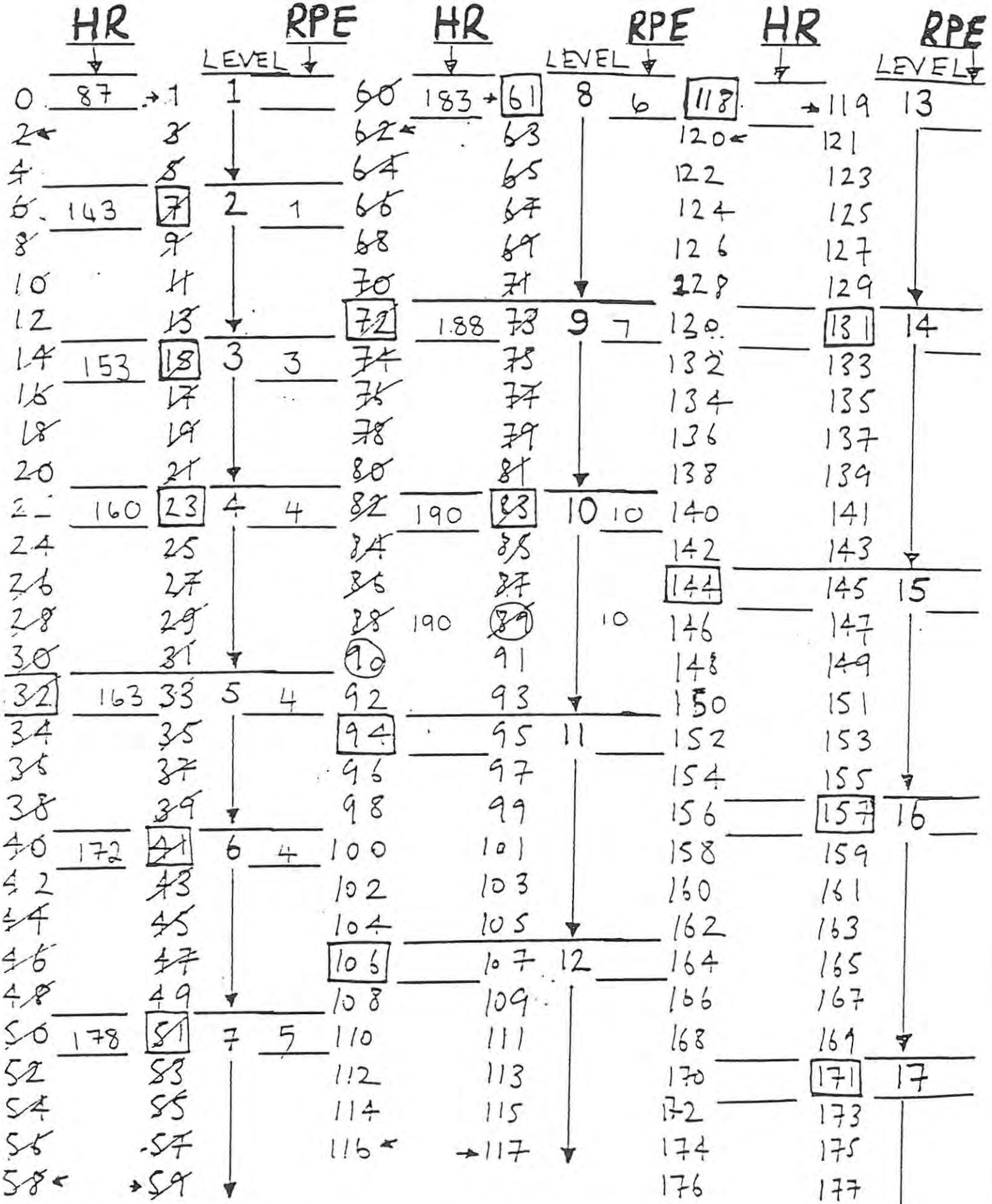

HR
RPE
LEVEL
87
143
153
160
163
172
178
183
188
190
190
118
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
6
7
10
10
NAME: SARAH BILBE (F)
AGE: 16
SCHOOL: DSG
CODE:
DATE 1/6/93

TABLE OF PREDICTED MAXIMUM OXYGEN UPTAKE VALUES

for the Multistage Fitness Test
Department of Physical Education and Sports Science
Loughborough University, 1987

LEVEL	SHUTTLE	PREDICTED $\dot{V}O_2$ MAX
4	2	26.8
4	4	27.6
4	6	28.3
4	9	29.5
5	2	30.2
5	4	31.0
5	6	31.8
5	9	32.9
6	2	33.6
6	4	34.3
6	6	35.0
6	8	35.7
6	10	36.4
7	2	37.1
7	4	37.8
7	6	38.5
7	8	39.2
7	10	39.9
8	2	40.5
8	4	41.1
8	6	41.8
8	8	42.4
8	11	43.3
9	2	43.9
9	4	44.5
9	6	45.2
9	8	45.8
9	11	46.8
10	2	47.4
10	4	48.0
10	6	48.7
10	8	49.3
10	11	50.2
11	2	50.8
11	4	51.4
11	6	51.9
11	8	52.5
11	10	53.1
11	12	53.7
12	2	54.3
12	4	54.8
12	6	55.4
12	8	56.0
12	10	56.5
12	12	57.1

Continued...

LEVEL	SHUTTLE	PREDICTED $\dot{V}O_2$ MAX
13	2	57.6
13	4	58.2
13	6	58.7
13	8	59.3
13	10	59.8
13	13	60.6
14	2	61.1
14	4	61.7
14	6	62.2
14	8	62.7
14	10	63.2
14	13	64.0
15	2	64.6
15	4	65.1
15	6	65.6
15	8	66.2
15	10	66.7
15	13	67.5
16	2	68.0
16	4	68.5
16	6	69.0
16	8	69.5
16	10	69.9
16	12	70.5
16	14	70.9
17	2	71.4
17	4	71.9
17	6	72.4
17	8	72.9
17	10	73.4
17	12	73.9
17	14	74.4
18	2	74.8
18	4	75.3
18	6	75.8
18	8	76.2
18	10	76.7
18	12	77.2
18	15	77.9
19	2	78.3
19	4	78.8
19	6	79.2
19	8	79.7
19	10	80.2
19	12	80.6
19	15	81.3
20	2	81.8
20	4	82.2
20	6	82.6
20	8	83.0
20	10	83.5
20	12	83.9
20	14	84.3
20	16	84.8
21	2	85.2
21	4	85.6
21	6	86.1
21	8	86.5
21	10	86.9
21	12	87.4
21	14	87.8
21	16	88.2

NAME:	AGE:	D.O.B: / /
SCHOOL:	STANDARD:	
DATE:		
MALE/FEMALE (CIRCLE)		
CODE:		

1. SOCIAL GROWTH	
2. SOCIAL CONTINUATION	
3. HEALTH AND FITNESS	
4. VERTIGO	
5. AESTHETIC	
6. CATHARSIS	
7. ASCETIC	
TOTAL SCORE	

1. How do you feel about the idea in the box?

PHYSICAL ACTIVITY FOR SOCIAL GROWTH

Taking part in physical activities which give you a chance to meet new people.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good _____:_____:_____:_____:_____ bad

of no use _____:_____:_____:_____:_____ useful

not pleasant _____:_____:_____:_____:_____ pleasant

nice _____:_____:_____:_____:_____ awful

happy _____:_____:_____:_____:_____ sad

2. How do you feel about the idea in the box?

PHYSICAL ACTIVITY TO CONTINUE SOCIAL RELATIONS

Taking part in physical activities which give you a chance to be with your friends.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good _____:_____:_____:_____:_____ bad

of no use _____:_____:_____:_____:_____ useful

not pleasant _____:_____:_____:_____:_____ pleasant

nice _____:_____:_____:_____:_____ awful

happy _____:_____:_____:_____:_____ sad

3. How do you feel about the idea in the box?

PHYSICAL ACTIVITY FOR HEALTH AND FITNESS

Taking part in physical activities to make your health better and to get your body in better condition.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good _____:_____:_____:_____:_____ bad

of no use _____:_____:_____:_____:_____ useful

not pleasant _____:_____:_____:_____:_____ pleasant

nice _____:_____:_____:_____:_____ awful

happy _____:_____:_____:_____:_____ sad

4. How do you feel about the idea in the box?

PHYSICAL ACTIVITY AS A THRILL

BUT INVOLVING SOME RISK

Taking part in physical activities that could be dangerous because you move very fast and must change direction quickly.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good	____	____	____	____	____	bad
of no use	____	____	____	____	____	useful
not pleasant	____	____	____	____	____	pleasant
nice	____	____	____	____	____	awful
happy	____	____	____	____	____	sad

5. How do you feel about the idea in the box?

PHYSICAL ACTIVITY AS THE BEAUTY IN MOVEMENT

Taking part in physical activities which have beautiful and graceful move-ments.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good	____	____	____	____	____	bad
of no use	____	____	____	____	____	useful
not pleasant	____	____	____	____	____	pleasant
nice	____	____	____	____	____	awful
happy	____	____	____	____	____	sad

6. How do you feel about the idea in the box?

PHYSICAL ACTIVITY FOR THE RELEASE OF TENSION

Taking part in physical activities to reduce stress or to get away from problems you might have.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good	____	____	____	____	____	bad
of no use	____	____	____	____	____	useful
not pleasant	____	____	____	____	____	pleasant
nice	____	____	____	____	____	awful
happy	____	____	____	____	____	sad

7. How do you feel about the idea in the box?

PHYSICAL ACTIVITY AS LONG AND HARD TRAINING

Taking part in physical activities that have long and hard practices. To spend time in practice you need to give up other things you like to do.

Always think about the idea in the box

If you do not understand this idea, mark this box ☐ and go to the next page

good	____	____	____	____	____	bad
of no use	____	____	____	____	____	useful
not pleasant	____	____	____	____	____	pleasant
nice	____	____	____	____	____	awful
happy	____	____	____	____	____	sad

PSPP and PIP Scoring Sheet

Name _____ Gender_____ Group _____ ID_____

PSPP Item scores (r = reverse scoring)

1 ___	2 ___	3r ___	4r ___	5r ___
6r___	7r ___	8 ___	9r ___	10___
11___	12___	13___	14r___	15___
16r___	17 ___	18r___	19 ___	20r___
21___	22r___	23 ___	24r___	25 ___
26r___	27r___	28r___	29 ___	30r___
___	___	___	___	___
SPORT	COND	BODY	STR	PSW

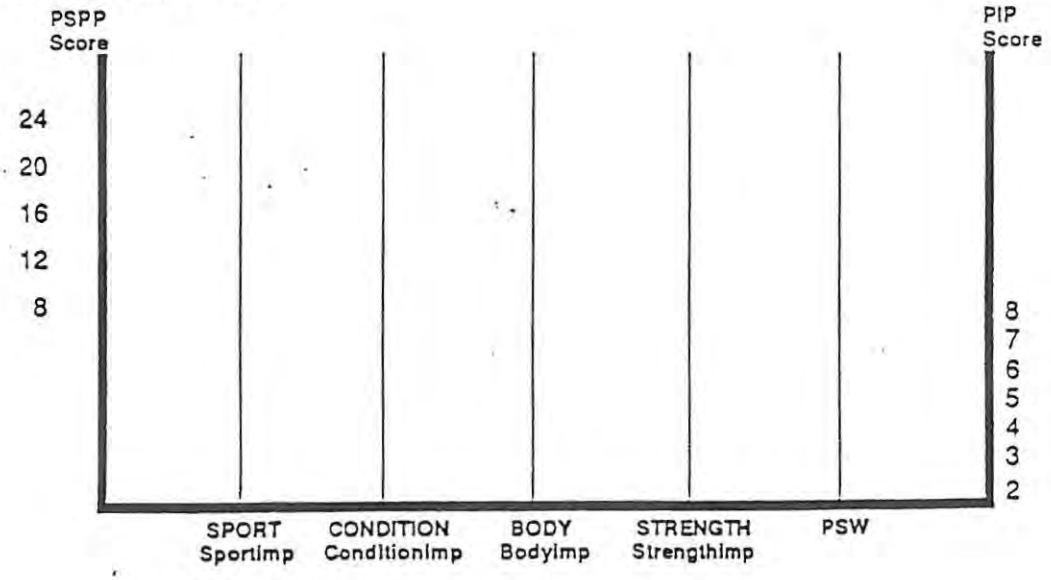
Subscale Totals

PIP Item scores (r = reverse scoring)

1r___	2 ___	3r___	4 ___
5 ___	6r___	7 ___	8r___
___	___	___	___
Sport Imp	Cond Imp	Body Imp	Str Imp

Subscale Totals

Perception Profile



HOW IMPORTANT ARE THINGS TO YOU?

	Really True for Me	Sort of True for Me			Sort of True for Me	Really True for Me
1.	☐	☐	Some people feel that being good at sports is vitally important to them	BUT	Others feel that being good at sports is not so important to them	☐	☐
2.	☐	☐	Some people do not feel that maintaining a high level of physical conditioning is very important to them	BUT	Others feel that maintaining a high level of physical conditioning is extremely important to them	☐	☐
3.	☐	☐	Some people believe that having an attractive physique or figure is vitally important to them	BUT	Others believe that having an attractive physique or figure is not all that important in their lives	☐	☐
4.	☐	☐	Some people believe that being physically strong is not so important to them	BUT	Others feel that it is extremely important to them to be physically strong	☐	☐
5.	☐	☐	Some people feel that having very good sports ability and skill is not so important to them	BUT	Others feel that having a high level of sports ability is really important to them	☐	☐
6.	☐	☐	Some people feel that maintaining regular vigorous exercise is vitally important to them	BUT	Others feel that keeping up regular vigorous exercise is not of prime importance to them	☐	☐
7.	☐	☐	Some people do not feel it so important to them to spend a lot of time and effort maintaining an attractive body	BUT	Others think that it is vitally important to spend time and effort maintaining an attractive body	☐	☐
8.	☐	☐	Some people feel that being strong and having well developed/toned muscles is vitally important to them	BUT	Others feel that being strong and having well developed/toned muscles is not so important to them	☐	☐

THE PHYSICAL SELF PERCEPTION PROFILE (PSPP)

WHAT AM I LIKE?

These are statements which allow people to describe themselves.
There are no right or wrong answers since people differ a lot.

First, decide which one of the two statements best describes you.

Then, go to that side of the statement and check if it is just "sort of true" or "really true" FOR YOU.

Really True for Me	Sort of True for Me	EXAMPLE			Sort of True for Me	Really True for Me
☐	☐	Some people are very competitive	BUT	Others are not quite so competitive	☒	☐

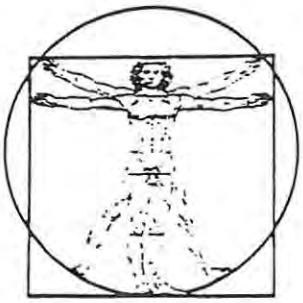
REMEMBER to check only ONE of the four boxes

1.	☐ ☐	Some people feel that they are not very good when it comes to playing sports	BUT	Others feel that they are really good at just about every sport	☐	☐
2.	☐ ☐	Some people are not very confident about their level of physical conditioning and fitness	BUT	Others always feel confident that they maintain excellent conditioning and fitness	☐	☐
3.	☐ ☐	Some people feel that compared to most, they have an attractive body	BUT	Others feel that compared to most, their body is not quite so attractive	☐	☐
4.	☐ ☐	Some people feel that they are physically stronger than most people of their sex	BUT	Others feel that they lack physical strength compared to most others of their sex	☐	☐
5.	☐ ☐	Some people feel extremely proud of who they are and what they can do physically	BUT	Others are sometimes not quite so proud of who they are physically	☐	☐
6.	☐ ☐	Some people feel that they are among the best when it comes to athletic ability	BUT	Others feel that they are not among the most able when it comes to athletics	☐	☐

	Really True for Me	Sort of True for Me			Sort of True for Me	Really True for Me
7.	☐	☐	Some people make certain they take part in some form of regular vigorous physical exercise	BUT	Others don't often manage to keep up regular vigorous physical exercise	☐ ☐
8.	☐	☐	Some people feel that they have difficulty maintaining an attractive body	BUT	Others feel that they are easily able to keep their bodies looking attractive	☐ ☐
9.	☐	☐	Some people feel that their muscles are much stronger than most others of their sex	BUT	Others feel that on the whole their muscles are not quite so strong as most others of their sex	☐ ☐
10.	☐	☐	Some people are sometimes not so happy with the way they are or what they can do physically	BUT	Others always feel happy about the kind of person they are physically	☐ ☐
11.	☐	☐	Some people are not quite so confident when it comes to taking part in sports activities	BUT	Others are among the most confident when it comes to taking part in sports activities	☐ ☐
12.	☐	☐	Some people do not usually have a high level of stamina and fitness	BUT	Others always maintain a high level of stamina and fitness	☐ ☐
13.	☐	☐	Some people feel embarrassed by their bodies when it comes to wearing few clothes	BUT	Others do not feel embarrassed by their bodies when it comes wearing few clothes	☐ ☐
14.	☐	☐	When it comes to situations requiring strength some people are one of the first to step forward	BUT	When it comes to situations requiring strength some people are one of the last to step forward	☐ ☐
15.	☐	☐	When it comes to the physical side of themselves some people do not feel very confident	BUT	Others seem to have a real sense of confidence in the physical side of themselves	☐ ☐
16.	☐	☐	Some people feel that they are always one of the best when it comes to joining in sports activities	BUT	Others feel that they are not one of the best when it comes to joining in sports activities	☐ ☐

	Really True for Me	Sort of True for Me				Sort of True for Me	Really True for Me
17.	☐	☐	Some people tend to feel a little uneasy in fitness and exercise settings	BUT	Others feel confident and at ease at all times in fitness and exercise settings	☐	☐
18.	☐	☐	Some people feel that they are often admired because their physique or figure is considered attractive	BUT	Others rarely feel that they receive admiration for the way their body looks	☐	☐
19.	☐	☐	Some people tend to lack confidence when it comes to their physical strength	BUT	Others are extremely confident when it comes to their physical strength	☐	☐
20.	☐	☐	Some people always have a really positive feeling about the physical side of themselves	BUT	Others sometimes do not feel positive about the physical side of themselves	☐	☐
21.	☐	☐	Some people are sometimes a little slower than most when it comes to learning new skills in a sports situation	BUT	Others have always seemed to be among the quickest when it comes to learning new sports skills	☐	☐
22.	☐	☐	Some people feel extremely confident about their ability to maintain regular exercise and physical condition	BUT	Others don't feel quite so confident about their ability to maintain regular exercise and physical condition	☐	☐
23.	☐	☐	Some people feel that compared to most, their bodies do not look in the best of shape	BUT	Others feel that compared to most their bodies always look in excellent physical shape	☐	☐
24.	☐	☐	Some people feel that they are very strong and have well developed muscles compared to most people	BUT	Others feel that they are not so strong and their muscles are not very well developed	☐	☐
25.	☐	☐	Some people wish that they could have more respect for their physical selves	BUT	Others always have great respect for their physical selves	☐	☐
26.	☐	☐	Given the chance, some people are always one of the first to join in sports activities	BUT	Other people sometimes hold back and are not usually among the first to join in sports	☐	☐

	Really True for Me	Sort of True for Me			Sort of True for Me	Really True for Me
27.	☐	☐	Some people feel that compared to most they always maintain a high level of physical conditioning	BUT	Others feel that compared to most their level of physical conditioning is not usually so high	☐	☐
28.	☐	☐	Some people are extremely confident about the appearance of their body	BUT	Others are a little self-conscious about the appearance of their bodies	☐	☐
29.	☐	☐	Some people feel that they are not as good as most at dealing with situations requiring physical strength	BUT	Others feel that they are among the best at dealing with situations which require physical strength	☐	☐
30.	☐	☐	Some people feel extremely satisfied with the kind of person they are physically	BUT	Others sometimes feel a little dissatisfied with their physical selves	☐	☐



HUMAN MOVEMENT STUDIES

Miss S Dartnell,
D.S.G.,
GRAHAMSTOWN

30 November, 1993

Dear Miss Dartnell,

Please find enclosed a copy of the abstract which pertains to the research work that I did at your school. Firstly I would like to thank you for your cooperation in setting up the testing sessions, selecting the subjects and not least by giving up your time, I do appreciate this as I was a PE teacher myself for 8 years and have a clear understanding of the pressures that you are under.

As a teacher of Physical Education I, like many other colleagues in our profession have become increasingly concerned with regard to the low participation exhibited by many young people in the realm of physical exercise and sport. This apathy towards physical activity is somewhat obscured by the mandatory nature of physical education lessons and after-school sports practices. It is clear that once young people leave school their aptitude and subsequent participation in any form of physical activity is very low indeed.

The title of my project was "Lifestyle Orientation of High Versus Low Achievers in Traditional School Sport: An Holistic Analysis. Essentially I was investigating the different ways in which high and low achievers experience the traditional sports in South Africa. I was interested in developing a profile the subjects with regard to the following variables which entailed morphological (stature, mass, % body fat, waist-to-hip ratio), physiological (aerobic capacity-VO_2 max, pre-exercise and exercise heart rate), and psychological (attitudes towards physical activity, physical self-perception and ratings of perceived exertion).

The subjects were divided into four groups; male high (Mhi) and low (Mlo) achievers, and female high (Fhi) and low (Flo) achievers. Congruent with previous studies of young South African's, the present sample (particularly Mhi, Mlo and Fli) were characterised by a desirable (in health and fitness terms) morphological and physiological profile. Although some of the Flo sample were relatively high in % body fat, no one in the study was clinically obese. General fitness (in terms of VO_2 max) was evaluated by the Multi-Stage Fitness Test, and according to the criterion laid down by Astrand and Rodahl (1977) the Mhi, Mlo and Fhi groups achieved a rating in the high performance fitness zone, while Flo were in the good fitness zone.

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Psychological evaluation produced some of the more interesting results, for they revealed how the subjects perceived a traditional sports programme. As might be expected both Mhi and Fhi responded in the most positive manner, with Mhi recording the highest score over all in Physical Self-Perception Profile (PSPP), and Fhi the highest in Children's Attitudes Towards Physical Activity (CATPA). However, it is important to note that on closer examination of the sub-domains of these tests that Mlo have a suppressed score in Sport, indicating that their experience of traditional sport is not necessarily an enjoyable one, while Flo appear to have the most negative and despondent experience. The Flo group appear to have responded in a negative manner in every aspect of these tests, indicating that traditional sports programmes do little to satisfy or serve their needs in terms of physical activity. It is important to note that this finding does not serve to criticize the school's evaluated, but is rather a reflection of a general inadequacy of sports and activity programmes in endearing young and adult females to be more physically active.

Considerable advances in the presentation and content of Physical Education syllabi have occurred in North America and Europe, particularly with the incorporation of Health Related Fitness programmes and a more diverse structured curriculum which also incorporates examinable PE (in academically recognized exams at 'O' and 'A' level standard) in both practical and theoretical aspects. These changes have done much to elevate the status of PE in a professional context, particularly in terms of eroding the image of a PE teacher as simply a games or sports coach, towards a person who is able to balance traditional expectations of PE with the development of knowledge and behaviours in pupils that have lifelong benefits in terms of their health and enjoyment of physical activity.

It appears that the results of this present study serve to reinforce the notion that the limited application, of PE largely in terms of the promotion of competitive school teams tends to marginalises individuals who are not predisposed towards these ideals. This was most notably demonstrated by the negative responses of the low achieving females (Flo) and to a lesser extent the low achieving males (Mlo).

I am aware that in many of your schools that you do run an interesting and diverse selection of activities. However it is important to remember that my research concerned itself with the individual's perception of traditional school sports such as rugby, hockey and cricket, and it is clear that the way in which these sports are perceived was closely linked to the sex and/or achievement level of the pupil.

If you would like a more detailed breakdown of the data I am more than happy to come to your school and discuss these findings in greater depth. Please do not hesitate to contact me at the Department of Human Movement Studies, Rhodes University, where upon we can make a time and date for a meeting.

Thank you again

Simeon Davies