THE RELATIONSHIP OF PERSONALITY TO BODY IMAGE IN ADULT WOMEN AND THE EFFECT OF EXERCISE ON THIS RELATIONSHIP

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For my children Mark, Simon and Natalie.

CONTENTS

ABSTRACT

This study was undertaken in order to investigate the relationship between personality and body image, and to ascertain the effect of exercise on measures of personality, body image and somatotype.

The subjects were 50 adult women in the age range 18-37 years who were assigned to either an exercising or non-exercising group at random.

Body image was measured using the Slade Body Image Estimation Apparatus and an Abacus. Personality was assessed by means of the Eysenck Personality Inventory and the Cattell Sixteen Personality Questionnaire. The subjects were also somatotyped by the Heath-Carter Method. Physical fitness scores, obtained for each individual before and after the conditioning programme, were based on the criterion of Ismail (1965).

The pre- and post-conditioning programme results obtained were analysed by repeated measures of analysis of variance, principal components analysis and discriminant function analysis.

The main findings were:-

(a) Two significant relationships between personality and body image existed in the study groups. These were an association between overall inaccuracy in body image estimation and Eysenck's neuroticism/extraversion, and correlation between accuracy in estimation of the Face and dominance and aggressiveness.

(b) Changes in personality through participation in exercise were found to be much less marked than hitherto suggested,

with only Cattell's 16PF Q_4 varying significantly, and some evidence for reduction in the EPI neuroticism factor.

(c) Repeated measures of analysis of variance showed a significant effect of exercise on body weight, percentage body fat, Ismail Fitness Score and on the Endomorphy component of the Heath-Carter somatotype.

(d) No significant changes in body image estimation could be demonstrated in the exercising group; there was nevertheless an association between fitness levels and body image.

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SECTION 1

INTRODUCTION

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INTRODUCTION

It has been proposed for the past twenty years that "athletic" performance at either end of the qualitative spectrum of performance is related to personality.

Many studies have shown, in a descriptive way, that to participate in sports of various kinds and at varying levels of performance, participants manifest a commonality of personality traits which many investigators have proposed as a sporting type unique to that particular activity. A number of longitudinal studies have proposed that personality, because of its plasticity in early adolescence, is moulded by participation, particularly in swimming. Sports psychologists have theorised that certain traits have a group manifestation and individuality gives way to a form of conditioning when people perform vigorous sporting activities in groups.

In studies of fitness conditioning programmes, personality traits have been influenced and changed by the effect of fitness on the individual (Kane, 1966, 1970, 1971, 1972, 1973; Berger & Littlefield, 1969; Jones, 1970; Whiting, 1972; Hendry, 1973; Harris, 1973). Relationships have been established between physical fitness and personality, and it has been shown that fitness can have a stabilising effect on personality factors (Young, 1976). Self-concept in general and body image in particular have not been studied extensively, and conclusive results are not established as to how the individual uses his body as a frame of reference in the decision-making process.

It has been demonstrated that human beings use their bodies as a framework for their awareness and psycho-physical orientation of themselves. Awareness of body image relates man to his environment by allowing him to experience the stimuli outside but, at the same time, separates man from space. It has also been suggested that one's body image is not static; instead it is dynamic, with a variety of images affected by changes in body weight, fitness and the ability to learn and perform new physical skills.

Man's whole being depends on the filtering of information through this framework and if a person has a distorted body image it could be postulated that the information processed, or processing mechanism, could be at fault. The study of body image, how one perceives oneself, is an important aspect of the body's psycho-physiological orientation. By and large, women's physiques may represent extremes of body composition categories (i.e. obese - non-obese). Consequently, it is interesting to investigate their body image and whether or not body composition changes affect this perception, and if the euphoria of physiological fitness changes manifests itself in a more conscious awareness of body image.

In a dynamic conditioning programme, the ability to perceive a variety of physiological limitations and to elasticate the needs past the pain threshold, is part of both the personality and image domains. It could be suggested that potential for any activity can be developed with success if man decided that the positive approach and mental attitude were goal-orientated to the same end.

When changes occur in the physical fitness of an individual, not only do personality traits become more stable, but the body image can be affected (Ilg & Ames, 1940; Schilder, 1935; Lerner,

1967; Drought, 1980). This is due to the activity and movement patterns involved in an exercise conditioning programme where participation in dynamic activity may promote a more positive body image. An exercise conditioning programme is known to affect body composition and resultant weight loss which, together with general toning up of the musculature, may be a way of positively enhancing body image.

Individuals who are in the field-independent end of the continuum of the Witkin classification of the perceptual styles of field-independence/dependence, have been shown to have a more positive body image. Field-independence enhances the individual's body as a frame of reference and results in a more dynamic and positive intervention into space. It may be postulated, therefore, that individuals who engage in regular physical activity may, as well as enhancing physiological function, improve in terms of the development of a positive body image.

1.1. Statement of the Problem

The problem is to investigate the relationships between selected physiological and psychological variables in exercising and non-exercising adult women.

1.2. Specific Aims of the Study

These may be summarised as follows:-

1. To investigate the relationships between, and among, selected measures of personality, physical fitness, body composition and body image in exercising and non-exercising adult Women females.

2. To determine the influence of an exercise conditioning programme on those underlying relationships identified between and among selected physiological and psychological variables.

1.3. Significance of the Study

The study of the relationship between physical abilities (especially those central to physical education and sports) and personality, has been of interest to sports psychologists for a long time. It has been argued, on the one hand, that in some ways not clearly defined, participation in physical education and sporting actitivies affects personality characteristics. Another view taken by the sports psychologist is that for a high level of sports involvement, in addition to physical ability, there is a need for certain psychological support and that the search for, and definition of, these particular psychological or personality supports would be useful. The research so far reported has been equivocal in demonstrating the extent and nature of the personality/physical abilities relationship. However, little investigation has been conducted between, and among, measures of psycho-physical orientation (body image), conceptual orientation (field-independence/dependence), psychological orientation (personality dimensions) and dynamic physical orientation (physical fitness) and the relative degree of inter-dependence of these indices.

It has been demonstrated by several researchers that both physiological and psychological benefits can be gained from participation in an exercise programme (Sterten et al, 1964; Young,

1976; Ismail & Young, 1976). The physiological gains in percent lean body weight and improved fitness indices can be shown to change when subjects have taken part in supervised, vigorous activities on a regular basis. The importance of psychological changes in the stabilising effects of personality traits have been documented and other investigators have manipulated the psycho-physiolgical variables to demonstrate that they are not due to chance (Goldman & Dill, 1975; Ismail & Trachtman, 1975).

Body image in young female adults with the psycho-physiological domains has never been investigated. The importance of investigating the body/mind relationship and quantifying the variables is an important aspect of the psycho-physiological orientation. To evaluate whether or not subjects who engage in an exercise conditioning programme are able to modify their body image because of this involvement is of paramount importance to the field of sports psychology. An investigation of the complexity of the relationship between the various domains of psycho-physical orientation, conceptual orientation, psycholgical orientation and how they are affected and manipulated by dynamic physical activity is an exciting venture. To be able to postulate which domain has the most effect on the psycho-physiological orientation can suggest the positive re-thinking of the involvement of people in activity programmes from school to adulthood. The known benefits not only can be expounded, but also this concept of body image can result in a more positive projection of self esteem.

The first aim of this study is to determine the nature and extent of the inter-relationships between and among the three

domains in order to facilitate a deeper understanding of their possible interactions. Data arising from the first aim of the study will add to the body of knowledge concerning the interactions within the three domains, and fill the gaps in the current knowledge concerning the contribution of body image to the concept of the body/mind relationship and provide a new insight among a relatively unresearched area of study.

The second aim of the study is to determine the influence of an exercise conditioning programme on the nature and extent of the relationships between and among the three domains. Data arising out of the second aim of the study will add to the body of knowledge concerning the psycho-physiological concomitants associated with exercise conditioning and specifically will be used to test the validity of the enhancement of psychological well-being.

1.4. Limitations of the Study

1. The number of subjects used in the study, exercisers and non-exercisers, was 50 and therefore the groups were 25 in the experimental group and 25 in the control group.
2. Only adult females were included with the age range of 18-35 years.
3. All the subjects were volunteers.
4. The variables selected to measure the conceptual domains of the study represented only a sample of the available measures.
5. There were fluctuations in the times of testing because of subject availability.
6. The diet and other physical activities of the subjects were not controlled.

1.5. Definition of Terms

The study will investigate the three domains of psycho-physical orientation. These are as follows:-

1. Personality

Trait — Cattell (1970) Sixteen Personality Factor Questionnaire Form A

Eysenck (1964) Personality Inventory

2. Body Image

Slade Russell (1973) body width self-estimation device. A novel body width dimension self-assessment procedure (Abacus).

3. Physiological Domain

(1) BODY COMPOSITION

Durnin and Rahman (1967) skinfold procedure for estimating body % of fat.

Heath Carter (1978) rating method for the assessment of somatotype.

(2) PHYSICAL FITNESS

Based on the criteria of Ismail et al (1965)

Variables	Beta Weights
a) exercise pulse rate	-1.329
b) percent lean body weight	4.880
c) max O_2 uptake ml/kg lean body mass	2.502
d) submax min volume vent/kg body weight	-119.017
e) resting diastolic blood pressure	1.310
f) resting pulse pressure	1.310
CONSTANT	61.9

SECTION 2

REVIEW OF LITERATURE

SECTION 2

REVIEW OF LITERATURE

2.1. Overview of Body Image

The psychological constructs which deal most directly with the relationship between the conceptualising mind and the body as both stimulus and object are the constructs of body ego, body boundary and body image. According to Schilder (1935) body image is the picture an individual has of her body which she forms in her mind. As the study of body image has progressed there are suggestions that the "normal" individual's feeling or attitude towards her body may be an important reflection of her identity which is developed within a framework, both cultural and environmental.

The development of body image is not confined to childhood where a child is constantly exploring and assessing her environment, but continues throughout life. It has been shown that changes in a person's physical condition (accidents, rapid gain or loss of weight, or other physical alterations) may alter the body image drastically. Kreitler (1970) postulated "that old or injured people perceive their bodies as broader and heavier than they really are".

Much of the research in the area suffers from an inadequate understanding of the psychology of body image. Many researchers have failed to recognise or "flag-up" that the body image is multi-dimensional, with postural affective and ideational components. Previous research has not sufficiently stressed the relationship of the body image concept to broader psychological issues. Many researchers have either failed to recognise, or have not

emphasised, the developmental sequence of body image as it moves from early global to a later articulated and differentiated state.

Body image is the body's perceptual framework which enables the individual to react and co-operate with the environment. Body image is classed as being somatic in origin because one's physical appearance and build moulds one's self perception in that it is an advantage to have a cultural image. Different eras have their own concept of the idealised body shape. For instance, the paintings of the 18th century depict rotund, voluptuous female forms. In the 1960's Marilyn Monroe typified the idealised woman's figure. During the 1970's, this shape changed to the waif-like figure of Twiggy.

Much confusion in the research into body image is due to the paucity and inadequacy of body image instrumentation and the lack of absolute criteria against which to validate proposed body image measures. For instance Stunkard and Burt (1967) relied on clinical interviews to determine the presence of body image disorders, while Grinker (1973) used disorting lenses. Also there is often little relationship between the operant hypothesis and the instruments used to test the hypothesis. For example, Gottesfeld (1962) attempts to measure the effective body image using the Draw a Person Test which is clearly a measure of the ideational body image.

The concept of body image needs to be clearly identified and with this in mind it would seem appropriate to distinguish the allied concepts of the body ego, body boundary and body image.

2.1.1. Body Ego

The structure of the ego system is concerned with the three components of body ego - body (ego), boundary, and body image - which form allied concepts. Rose (1966) defined the body ego as the psychic representation of the bodily self in the ego system. The bodily self includes and extends beyond the body boundary and body image to include one's clothing, objects and products. Landis (1970) stated that Freud felt that the body ego was the first stage of ego development. While it is often said to constitute the central core of the ego as a whole, the body ego is an intermediate level between the raw data arising from body experience and personality. This relationship enables the body ego experiences arising from various levels of bodily experience to be integrated and organised with the ego.

From a psychoanalytic view the main function of the body ego in development allows the process of differentiation of the self from fusion with the mother's body and the environment to a complete separation between what is "me" and what is "not me". Bemporad (1974) writes to say that Piaget suggests that the same developmental sequence from fusion to differentiation is achieved by action, e.g. physical activity performed by the infant upon physical objects and by exploring the environments by bodily movements which leads to more interactions and the acquisition of environmental reaction.

2.1.2. Body Boundary

The concept of the body boundary is subsumed under the concept of the body ego. The phenomenological sensation and the function of the body boundary has been described by Laing (1969) as follows:-

"We feel ourselves to be inside a bag of skin; what is outside this bag is not us. Me - inside. No - me outside" (p23). This description by Laing implies that the body boundary concept is closely tied experimentally to sensory input from the body. Immediate sensory feedback is available to distinguish between "where I end and where the rest of the world begins".

Since the early 1970's, Fisher and his colleagues (1972) have studied the body boundary. Their research has been able to demonstrate that the body boundary can be conceptually distinguished from the body image. Their earlier work focussed on the quality of the boundary, i.e. its permeability or firmness. That is the phenomenological sensation of the boundary's ability to be <u>penetrated</u> to let things come in, as opposed to the sensation of the boundary's function as a <u>barrier</u> to prevent things from penetrating. In their later work, Fisher and Cleveland (1958) turned their attention to examining the articulation, awareness and accuracy of the body boundary.

Reitman and Cleveland (1964) have described the body boundary concept in terms of :- "the tendency of the individual to perceive his body image as definite and well delineated versus vague and imprecise" (p164). It was found that a well articulated and accurate body boundary was firmly bounded, whereas a vague body boundary was more permeable. Fisher (1970) correlated the quality of the body boundary with personality variables and postulated that:-

"the more definite an individual's boundaries the more likely he (she) is to perceive him(her)self as possessing clear-cut identity and to have a concept of his (her) body as a well differentiated scope of space equated with the self". It was also suggested that

women with a well articulated body boundary were found to be goal directed, self-motivating, well individuated, to have a clear sense of self identity and personal maturity. Obviously the converse was true for those with a poorly articulated body boundary.

2.1.3. Body Image

It would seem that the body boundary surrounds the body image and both are inter-related, causing one to be affected by the other. This relationship between our body's experiences has often been confused. In Fisher's writings it is often difficult to distinguish whether he is referring to the body image or the body boundary. Likewise, the relationship between the body image and the body ego is equally confusing. These two concepts are said to be self representations of the body as a psychological experience within the ego system (Rose, 1966; Landis, 1970). Landis postulates that the body image is subsumed under the concept of the body ego, whilst the latter is larger and incorporates a greater psychological component.

The body image is composed of a number of discrete and inter-related component parts, which refer to the body as a psychological experience. These psychological experiences "start up" a series of cognitive constructions (schema) which develop from past and current sensations. These experiences are the result of sensory social information which arises from the body when it is thought of as an object.

Kolb (1975) has used the terms 'images' or 'schema' as though they are interchangeable but it is imperative to appreciate the essential difference between body image and body schema. It has been suggested by Ulric Nesser (1976) that schemata and perceptual

activity constitute a dynamic feedback system. The perceiver is directed to select out from an array of possible perceptions those items which the perceiver conceptualises as reality. Information which does not translate into this concept is ignored or it will alter the scheme. At the other end of the continuum an image or a percept refers to the schema when it is not involved in the perceptual process and is either being examined as an object in itself or when logical manipulations are being performed in as during experimental testing or measuring situations. Images direct the focus of attention and as such function as anticipators and facilitators or subsequent perceptions. When we qualify the image and try to determine its clarity vagueness or accuracy, this in turn affects the quality of the perceptions.

Many researchers in the body image domain have not uniformly identified its various dimensions. In 1935 Schilder divided the body image concept into postural, libidinal and social components which moulded dimensions of the body image during its development. In contrast, Shontz (1975) proposed a four level system of body image experiences consisting of the body schema, the body self, the body fantasy and the body concept, while the Kolb (1975) system included the body percept, the body concept, the body ego and the body ideal. The classification by Kessler (1978) is the most rigorous concept of the body image and consists of three components, the postural body image, the ideational body image and the affective body image. As Kessler says:- "Each of these can be examined from the stand point of a) what it consists of b) how the image developed, and c) which research instruments best fit its conceptual framework." The postural body image is at the most fundamental and primary level of experience.

2.1.4. Postural Body Image

The schema of the postural body image is essential in order to properly perform a variety of functions, for example locate a stimulus on the body surface; orient the body in space; relate the body to other objects in space; perceive the size and shape of the body; and anticipate, plan, imagine, begin and co-ordinate motor activities from the simplest (e.g. moving the hand to the mouth) to the most intricate (e.g. performing a pirouette in ballet). Generally operating on a preconscious level, as a background in a gestalt, the postural body image can be made available to the conscious mind. Athletes and dancers consciously and directly manipulate the postural body image (Sweigart, 1975). For example, dancers often create images of themselves performing the sequences of a dance movement and correct their movements in their mind's eye before performing the movement.

Adequate and accurate postural body image is required for overall psychological development and adjustment, as well as the ability to orient and move in space, to take actions, to act and move effectively and efficiently (Schilder, 1935).

The postural body image emerges as the infant uses, explores and experiences its body in relation to itself and its environment. As the child matures and learns to observe itself and others and to make comparisons, the visual sense assumes a greater role in the development of the postural body image. Movement is required not only to activate the kinesthetic sense, thereby providing enterioceptive information, it also facilitates contact with reality by stimulating the tactile sense which provides exterioceptive information. Touching and being touched, making contact with self and others, constitute the first forms of contact

with, and consequently knowledge of, reality. Schilder believed that without motility, the postural body image would not develop normally. He further stated that movement is necessary not only during infancy, when the body image is first forming, but continuously throughout life in order to incorporate new information about the body as it changes. The postural body image proceeds from vague and global to concrete, discrete, and discriminating perceptions. Its development requires a dynamic process. Assumption is made that the postural body image has the capacity to remain dynamic once physical maturity is reached and will become "remarkably stable [static] over time" (Shontz, 1975), unless new information is made available.

Since the postural body image is most directly accessible via the sensory apparatus, it is readily tested using instruments which rely upon the kinesthetic, tactile or visual senses. Some of the devices that have been used to measure the postural body image, specifically the perception of body size component of postural body image, are the amorphic lenses used by Glucksman and Hirsch (1969), the flexible mirrors used by Traub and Orbach (1964), the Gottschlat Persona Test used by Meyer and Tuchelt-Gailwitz (1968), and the Size Estimation Apparatus known as the SEA (Slade and Russell, 1973).

The amorphic lens, which has been widely used, consists of a photograph of the subject (standing in swimsuit), which is projected onto a screen. The screen image can be adjusted at regular intervals to project a smaller or larger image. The subject is required to adjust the screen image (the picture of herself) so that it conforms to the image she has of the size of her body. The external cue, the picture, is present during the experimental

situation. The individual has to compare the external cue with her internal image. Neisser (1976) has suggested, however, that we cannot manipulate images while performing another perceptual task. The comparing of an image with a perception, the photograph, might produce inhibition of either the external percept or the internal image.

Another widely used device is the SEA. It was developed by Slade and Russell (1973) who credit Reitman and Cleveland (1964) for devising the first such test as a test of body image distortion to be used with anorexic and obese patients. In contrast to the lenses, the SEA does not provide the subject with any external cue. It consists of two lights mounted on a horizontal bar which the subject adjusts to indicate the <u>width</u> of separate, discrete body parts such as the width of the face, chest, waist, hips etc. This procedure has the advantage of demonstrating detailed and specific areas of distortion in contrast to the lenses and mirror devices, which require whole body perception. Also, the SEA requires that a subject rely mainly upon immediate internal cues and the image of his or her body which has been built up over a period of time. Of all the devices, it comes closest to tapping what Neisser (1976) refers to as the internal image which has the effect of being anticipatory to behaviour. Neisser has shown that this internal image can be mentally manipulated and is available for testing in experimental situations.

2.1.5. Body Image and Physical Activity

The body image needs an involvement in physical activity in order to be enhanced in a positive way. D H Harris (1973) informs us that "the body image is developed within the framework of

experiences of the body and the memory of these experiences". It is known that there is an association between the postural body image and activity, so that a poor postural body image may interfere with physical activity. The work of Kreitler (1973) with the aged has indicated that a reduction in movement not only leads to muscle degeneration but also has many psychological effects. He suggested that people who do not engage in exercise tend to have a more distorted body image, estimating themselves to be wider than they really are.

Several studies have found evidence that body image is improved by exercise. High school girls of high physical fitness were found by Schultz (1961) to have a more positive body image than less fit girls. A group of children with neuromuscular problems was assessed in Bonniwell's study (1981) for body image. The children were then involved in individual physical development programmes. After the programmes there was a significant relationship between improved confidence, classroom achievement and body image. Bedard et al. (1978) did not find any evidence of a more positive body image among female physical education students. There was, however, a significant correlation between the degreee of definition of individual students' body images and the number of hours each week those students devoted to physical activities. Harris (1973) noted that men who had been habitually active throughout their lives had generally more positive self concepts and tended to be confident of their physical abilities and movement patterns. She also suggested that success in physical activity participation encourages a positive body image.

The research linking female subjects with body image and activity has interested investigators in American universities.

Cremer and Hukill (1969) used 77 undergraduate students from a basic physical education programme to investigate the effect of "idealised" body weight on perceptions of body contours. The investigators used a battery of anthropometric measures and then the subjects were asked to select a set of paired figures from drawings of the idealised female figure. They were also required to alter the body lines so that their own body lines were represented. The results of the study indicated that the greater the deviation in weight from that considered "desirable" in terms of height and age, the greater the difference between perceived body contour lines and real ones. Snyder and Kivlin (1975) investigated measures of psychological well-being and body image between women athletes and non-athletes, gymnasts and basketball players. Their results showed that women athletes had higher scores than non-athletes on both measures of psychological well-being and body image. Whilst the gymnasts had higher scores on the psychological well-being items than the basketball players, the measures on body image between the two sports were inconclusive.

In Scotland an investigation by Drought (1980) used a questionnaire to investigate male and female undergraduates' concepts of body image. His findings indicated that males tended to be more content with their actual height and weight, and associated involvement in sport with a "good looking" body. Women, on the other hand, were inclined to regard themselves as overweight. Both sexes ranked given aspects of body image in the following order of importance; body shape, grace of movement style, bearing, body size and clothing.

Dosamantes-Alperson and Merrill (1980) studied two groups of females undergoing an experimental movement programme; one of the

groups was a ballet class. They concluded that there were significant changes attributable to the therapy, and detectable in six measures of self-actualisation 1) inner directness, 2) existentiality, 3) feeling reactivity, 4) spontaneity, 5) self-acceptance, and 6) capacity for intimate contact. Gwyon (1985) investigated the effect of ballet training on the postural body image of adolescent females. She compared two groups of adolescent females aged between sixteen and eighteen years; one group were full-time dance students and the other matched group were sixth-formers. The dance students had a significantly more positive body image than the non-dancers. The dancers also showed less distortion among the four body sites than the non-dancers.

Prakasa and Overman (1986) investigated psychological well-being and body image between black women athletes and non-athletes attending a State University. The investigators used 32 body image descriptions in questionnaires, and used psychological well-being as a dependent variable. The collected data were analysed using a stepwise multiple regression and it was revealed that women athletes expressed a more positive body image on 13 items than did non-athletes. The researchers' conclusions were that there is a significant relationship between body image and athletic participation. When comparing women athletes to non-athletes, it was found that athletes express a more positive attitude towards either their body parts or body processes, i.e. digestion, appetite.

Ward and McKeown (1988) investigated the effect of a ten week aerobic dance exercise programme on body cathexis. The subjects were 41 college-aged females who responded to a 28-item Body Cathexis scale. The anthropometrical variables were height, weight,

six separate site skinfold measurements and measurements of the appropriate muscle circumferences (for example, biceps and calf). The total group were subsequently divided into subjects with negative or positive body cathexis scores and analysed for significant cathexis or anthropometrical differences. The results indicated that an aerobic dance exercise programme operating on two days a week will have a minimal effect on body cathexis.

Marsh and Peart (1988) in Australia, using high school girls as subjects, investigated the effect of competitive and co-operative fitness programmes on self-concept. The results showed that both competitive and co-operative fitness programmes enhanced fitness and self-concept of physical ability. The other factors of self-concept were found to correlate positively with a co-operative fitness programme.

2.1.6. Summary of Body Image

A review of literature has indicated that individuals assign to their bodies, in terms of their own personal standards, qualities of shape, size and attractiveness (Fisher and Cleveland, 1958). This, on the other hand, can be an erroneous concept, for an individual's perception of his body may not correlate with his actual body characteristics. The concept of body image has not been well defined by many researchers (Rose, 1966; Fisher, 1970; Landis, 1970). There has been a tendency to confuse the concepts of body ego, body boundary and body image, and the terms have been used almost interchangeably. Kolb (1975) added to the confusion by interchanging the terms "images" and "schema". This inability to define the concept of body image has made the development of instrumentation to measure body image difficult. Many studies have

used questionnaires and check lists to measure body image. This lack of uniformity has led some researchers (Gottesfeld, 1962; Stunkard and Burt, 1967; Grinker, 1973) to use an inappropriate instrument to measure their operant hypotheses. The definition of postural body image by Kessler (1978) has clarified the place of body image in the psychological field, and her use of the Slade Estimation Apparatus has allowed replication of the measurement of body image.

Harris (1973) and Kane (1973) have demonstrated that involvement in physical activity has enhanced the development of positive body image. Harris's studies have also suggested that the development of the postural body image is very much dependent on outside stimuli. Furthermore, the development of an accurate and articulated body image is of necessity dependent on being exposed to the wide spectrum of physical activity. At the other end of the continuum, involvement in physical activity is very much dependent on body image. Hunt (1964) has postulated that children who have a poorly articulated body image will not participate in physical activity. Several studies (Schultz, 1961; Cremer and Hukill, 1969; Ward and McKeown, 1988; Marsh and Peart, 1988) have indicated that body image scores measured by different instrumentation can be improved in physical fitness programmes.

None of the studies in the literature reviewed attempted to measure changes in postural body image using adult women as subjects. Some of the studies failed to use a control group or matched subjects to provide a base-line for all subjects, necessary to show that any obtained improvement in body image scores is due to a physical fitness programme.

This study will investigate the complex relationship between body image and personality and will, by the use of a control group of matched subjects, demonstrate how involvement in a vigorous exercise regime affects the relationship between body image and personality.

This study will measure the postural body image by using the SEA, which requires the subject to rely mainly upon immediate internal cues and the image of her body which has been developed over time. To complement the SEA, an abacus will also be used, which ensures that the subjects' kinaesthetic and proprioceptive systems, which are an itegral part of the body image, are also measured. By using these two instruments, which the subject herself will control, no experimental bias will interfere with the obtained results.

2.2. OVERVIEW OF SOMATOTYPE

Man may be a single species but we are all varied in our body build. Whilst ethnic differences may add a great deal to this heterogeneity, it has been suggested from the days of Ancient Greece that this physical diversity of build may be the cause of our individual personality. Hippocrates (336-420 BC), the founder of modern medicine, proposed a number of relationships between temperament and body types. He suggested that an individuals susceptibility to disease was the result of his body shape. If one examines Shakespeare's plays, the relationship between body type and temperament is described in the pen-pictures of his characters, for example the lean brooding Casius, the rotund and sociable Falstaff, whilst Harry Hotspur is muscular and action orientated. These descriptions may be stereotypes but they reflect the concepts that people believe to be the behavioural action of a person's physique.

In 1920, Ernst Kretschmer, a psychiatrist working in Germany, implemented the first scientific study of the relationship between personality and physique. Kretschmer had observed in his hospital work with the two most common categories of mental patients (schizophrenics and manic depressives) that they seemed to have markedly different physiques. He referred back to earlier concepts of the body-temperament relationships and decided to adopt a traditional trichotomy:-

1. the muscular
2. the rounded-visceral
3. the light slender

He then used a series of checklists to describe the bodily characteristics of his hospitalised manic depressives and schizophrenics. The following bodily measurements of the patients were taken; the relative length of the thorax to the abdomen; rib angle; width or depth of chest; thickness of elbow joints and wrist bone. These body measurements were then tabulated against the patient's form of illness. The results in Kretschmer's book "Physique and Character" were clear cut; manic depressives were characterised by what he labelled "pyknic body type" (that is they had extreme visceral development and possessed a great deal of fat); whilst on the other hand schizophrenics were typically asthenic type (thin, narrow and of a light skeletal constitution). Kretschmer's clasification of these extreme body types only applied to a minority of people. He then made two further categories; the "athletic" and the "dysplastic" or mixed types. Wells (1983) suggests that "obvious classification problems continued to arise from this sort of pigeon holing taxonomy. Most individuals are, in the nature of things, average or indeterminate".

In hindsight, further criticisms could be made of Kretschmer's typologies of the frail, asthenic schizophrenic and the rotund heavily built, fat manic depressive. In modern psychiatry the ageing factor would play a major part in the onset of mental illness. Schizophrenia most commonly occurs in young people, when in the main they are the most fat free, whilst on the other hand middle age, when the average population is becoming rotund and overweight, is generally the time for the onset of manic depressive psychosis. But Kretschmer's pioneering work was the first attempt to categorise physique and behaviour.

In the 1940's a psychologist, William H Sheldon, working at Harvard University, developed a method of somatotyping based on Kretschmer's work. The subjects were 400 undergraduate students. Although not typical of the normal population, this was offset by the scientific control and quantification of the investigation. The subjects were photographed in three positions, posed in the standard nude position, frontal, side and backview. The subjects were then weighed, measured for height and diameters in various body sites. A cluster of seventeen anthropometric measurements were made which could be expressed as ratios to the height of the individual. The method combined three components in a highly objective manner, and in all cases produced an actuarial estimate of the somatotype. The three variables which were employed to make up the somatotype were:-

1. Ponderal Index (height/cube root of weight)
2. Trunk Index (a ratio of the upper torso [thoracic trunk] to lower torso [abdominal trunk]) derived primarily from the front view of the standard photograph
3. Mature Height.

These physical measurements not only lead to an overall score for each of the components, but also provided ratings for five different areas of the body;

head, neck

chest, trunk

arms, stomach

trunk, legs.

The three primary components which made up the somatotype were named:-

1. ENDOMORPHY - which concerns the degree of roundness of the physique and the inclination to put on fat. There is large abdominal cavity but a small skeletal frame. The hands and feet are on the small side.
2. MESOMORPHY - there tends to be a massive skeletal development with broad shoulders and good muscular development.
3. ECTOMORPHY - the skeletal bones are light and frail. When the component is dominant linearity is most marked. Height is maximal in proportion to weight.

For classification purposes all subjects were assigned a score from one to seven for each of the components, with one referring to a minimum and seven a maximum. A subject could then be identified by a three number code. The three figure ratings were conventionally listed in the following sequence; endomorphic, mesomorphic and ectomorphic. Sheldon and his co-workers found that by using grids they could substitute measures derived from the three standard photographs instead of actually measuring the subjects' diameters at the various sites.

The next step in the investigation was an attempt to measure personality and to investigate the relationship between physique and temperament. The personality literature was scanned and a list of 650 traits was extracted. To this list was added variables which Sheldon in his observations had found to relate to physique. The number of traits was carefully reduced by examining for overlapping dimensions and the elimination of those traits which were deemed to be of no significance. A total of 50 traits were abstracted and these, Sheldon postulated, seemed to represent all the specific phenomena that had been dealt with by the original 650 traits.

A group of 33 subjects was selected and they were studied for one year through the medium of observation in their everyday activities and in numerous clinical interviews. The subjects were rated on a seven point scale for each of the fifty traits and the resultant scores were inter-correlated in order to discover clusters of traits. Three major clusters were found and these included twenty-two of the original fifty items. A final inter-correlation study with one hundred subjects resulted in theselection of twenty traits for each of the three clusters. The traits that were finally selected are summarised in Table 1.

The first component of temperament was named viscerotonia. An individual high in this component is characterised by general love of comfort, sociability, and gluttony for food, people, and affection in their relations to others, and is generally an easy person to iteract with. Sheldon suggests "The personality seems to centre around the viscera. The digestive tract is king, and its welfare appears to define the primary purpose of life."

The second component was called somatotonia. A high score in this component is ordinarily accompanied by love of physical adventure, risk-taking, and a strong need for muscular and vigorous physical activity. The individual is aggressive, callous towards the feelings of others, over-mature in appearance, noisy, courageous, and given to claustrophobia. Action, power, and domination are of first importance to such an individual.

The third component was labelled cerebrotonia. An elevated score on this component implies restraint, inhibition, and the desire for concealment. The individual is secretive, self-conscious, youthful in appearance, afraid of people, and happiest in small enclosed areas. He or she reacts over-quickly, sleeps

TABLE 1 - THE SCALE FOR TEMPERAMENT (Sheldon, 1948).

VISCEROTONIA	SOMATOTONIA	CEREBROTONIA
( ) 1. Relaxation in posture and movement	( ) 1. Assertiveness of posture and movement	( ) 1. Restraint in posture and movement, tightness
( ) 2. Love of physical comfort	( ) 2. Love of physical adventure	2. Physiological over-response
( ) 3. Slow reaction	( ) 3. The energetic characteritistic	( ) 3. Overly fast reactions
4. Love of eating	( ) 4. Need and enjoyment of exercise	( ) 4. Love of privacy
5. Socialization of eating	5. Love of dominating. Lust for power	( ) 5. Mental over-intensity. Hyper-attentionality. Apprehensiveness
6. Pleasure in digestion	( ) 6. Love of risk and chance	( ) 6. Secretiveness of feeling, emotional restraint
( ) 7. Love of polite ceremony	( ) 7. Bold directness of manner	( ) 7. Self-conscious mobility of the eyes and face
( ) 8. Sociophilia	( ) 8. Physical courage for combat	( ) 8. Sociophobia
9. Indiscriminate amiability	( ) 9. Competitive aggressiveness	( ) 9. Inhibited social address
10. Greed for affection and approval	10. Psychological callousness	10. Resistant to habit and poor routinizing
11. Orientation to people	11. Claustrophobia	11. Agoraphobia
( ) 12. Evenness of emotional flow	12. Ruthlessness, freedom from squeamishness	12. Unpredictability of attitude
( ) 13. Tolerance	( ) 13. The unrestrained voice	( ) 13. Vocal restraint and general restraint of noise
( ) 14. Complacency	14. Spartan indifference to pain	14. Hypersensitivity to pain
15. Deep sleep	15. General noisiness	15. Poor sleep habits, chronic fatigue
( ) 16. The untempered characteristic	( ) 16. Over-maturity of appearance	( ) 16. Youthful intentness of manner and appearance
( ) 17. Smooth, easy communication of feeling, extraversion of viscerotonia	17. Horizontal mental cleavage, extraversion of somatotonia	17. Vertical mental cleavage, introversion
18. Relaxation and sociophilia under alcohol	18. Assertiveness and aggression under alcohol	18. Resistance to alcohol and to other depressant drugs
19. Need of people when troubled	19. Need of action when troubled	19. Need of solitude when troubled
20. Orientation toward childhood + family relationships	20. Orientation toward goals and activities of youth	20. Orientation toward the later periods of life

poorly, and prefers solitude, particularly when troubled. Such an individual consistently attempts to avoid attracting attention to him or her self.

The three general dimensions, together with the twenty defining traits for each dimension, make up the Scale for Temperament that is an elaborate rating procedure for arriving at scores for each of the primary components. Sheldon recommends in using the Scale that where possible:

> "Observe the subject closely for at least a year in as many different situations as possible. Conduct a series of not less than twenty analytic interviews with him in a manner best suited to the situation, and to the temperaments and interests of the two principals ..... After each interview ..... turn the score sheet and assign a rating on as many of the traits as possible .... Repeat the observations, interviews, and revisions of ratings until reasonably satisfied that all of the sixty traits have been adequately considered and evaluated."

Over the next five years Sheldon (1942) carried out a study of two hundred male, white subjects who were college students or college graduates. The subjects were rated on the temperament dimensions as defined in the Scale of Temperament after many months of observation, and then each subject was somatotyped. The most significant finding in this study was the high correlations between the temperament variables and the physique variables as shown in Table 2.

TABLE 2

CORRELATION BETWEEN PHYSIQUE COMPONENTS AND TEMPERAMENT COMPONENTS

	Viscerotonia r	Somatotonia r	Cerebrotonia r
Somatotype	(n=200)	(n=200)	(n=200)
Endomorphy	+0.79	-0.29	-0.32
Mesomorphy	-0.23	+0.82	-0.58
Ectomorphy	-0.40	-0.53	+0.83

These results would seem to suggest that there is a relationship between temperament and somatotype. Sheldon suggests:-

> "These are higher correlations than we expect to find, and they raise some questions of great interest. If we were to regard the product-movement correlation as a measure of the degree to which two variables are made up of common elements, correlations of the order of +0.80 would suggest that morphology and temperament, as we measure them, may constitute expressions at their respective levels of essentially common components ..... If we have already reached basic factors in personality, the correlations are not higher than should be expected, for then with the two techniques we are but measuring the same thing at different levels of its expression."

The results obtained from the many studies which Sheldon and his co-workers completed over many years would seem to underpin a

relationship between temperament and physique. For Sheldon's investigation would seem to postulate that:-

The somatotype is viewed as a means of estimating or approximating the basic and unchanging biological determinants of behaviour (Morphogenotype) through measures in large part based upon the external observable body phenotype.

Lindsey (1967) and Rees (1968, 1973) on examining the many studies conducted by Sheldon, are convinced: "that Sheldon is eminently correct in his assertion that there is a highly significant association between physique and personality", Hall and Lindsey (1973).

In recent years one of Sheldon's successors has been R W Parnell (1958) who has worked with many variant subject groups. Parnell has included anthropometric measures in his assessment of "phenotyping" as well as the standard three photographs. The anthropometric measures included height, weight, bone measurements, muscle circumference measures and skinfolds taken at three sites with calipers. These techniques were used on two thousand and sixty three undergraduate students from the universities of Oxford and Birmingham in the initial establishment of this technique. Many other subjects from women to children have been investigated to add more data to the technique of phenotyping.

In the 1960's a modified somatotype method was devised by Heath and Carter (1968) and is now the current method in popular practice. In the Heath-Carter Method the somatotype is defined as a description of the present morphological conformation. The Heath-Carter classification is similar to Sheldon's (a three digit classification) and it does use an open-ended scale. It is expressed in a three- numerical rating, consisting of three

sequential numbers (components) always recorded in the same order. The somatotype involves the measurements of height, weight, bone dimensions, muscle circumference measures of biceps and calves, and four skinfold measurements at the sites of biceps, triceps, subscapular and suprailiac. A somatotype rating is calculated for the subject by the following method:

To obtain the first component (endomorphy) the three skinfolds (triceps, subscapular and suprailiac) are added together, then the closest value on the F-scale is circled and the rating for that column is recorded.

Mesomorphy (second component) is obtained by marking the subject's height on the height scale. Then, for each bone diameter, the figure is circled in the appropriate row nearest to the exact measurement. The tricep skinfolds and the calf skinfolds are subtracted from the bicep girth and the calf girth respectively before circling the figure which is the nearest measurement in the appropriate row. Next, dealing only with columns, the point that is the average of the circled figures for the diameters and girths only is marked. The number of columns by which the average deviates right or left from the marked height is counted and this number of columns, right or left, are moved from the four in the second component and the closest rating value is circled.

To obtain the third component, ectomorphy, $_3 \frac{\text{Height}}{\text{Weight}}$ is found from a nomogram (Heath and Carter, 1968) and recorded by circling the closest value in the L-scale and the rating for that column is recorded.

The values for each rating scale are recorded after 'anthropometrical somatotype' at the bottom of the form. The ratings of each

component are theoretically at zero and have no end-point.

Slaughter and Lohman (1976) tend to support the Heath-Carter method. They observe that while Sheldon's endomorphy is closely associated with height and weight, the Heath-Carter first component is significantly associated with lean body mass for a given body weight. Sheldon's somatotype for all three components is not as closely related to body composition as the Heath-Carter method, which describes body morphology as well as body composition.

Heath (1963) observed that somatotyping has aroused more controversy than enthusiasm, and many questions have been posed about the techniques, methodology and findings about somatotype. The Heath-Carter method does seem able to classify and quantify the physical characteristics of subjects, thus making this method of somatotyping one that many researchers can use, enabling similar results to be obtained with diverse subject groups.

Bale, Rowell and Colley (1985) investigated the anthropometric and training characteristics of female marathon runners as determinants of distance running performance. The Heath-Carter method of somatotyping was used in the study. The results indicated that the most successful female marathon runners were those who had less body fat and were high on the component of ectomorphy.

Meleski and Malina (1985) investigated body composition changes and physique of elite university females. The study showed that the intensity of training in the season only affected the first (endomorphy) and third (ectomorphy) components of somatotype in a minor way.

Adams and Bolowchuk (1985) investigated the relationship between personality and somatotype. Their subjects were one hundred males aged 17-20 years. The Heath-Carter method of somatotyping was

used and the subjects were given the Cattell Sixteen Personality Factor Questionnaire. A canonical analysis of the data revealed that although there were significant correlations between personality traits and somatotype, these correlations were few and possibly the result of chance.

The new science of Kinanthropomtery has utilised the Heath-Carter method of somatotyping. In the Proceedings of the VIII Commonwealth and International Conference on Sport and Physical Education, Dance, Recreation and Health (1986), published in Kinanthropometry III, edited by Reilly, Watkins and Borms, are a number of papers which utilised the Heath-Carter method of somatotyping. Stepnicka (1986) investigated groups of:

1. Czechoslovak top athletes
2. University students (men)
3. Czech school youth (boys and girls)
4. Boys attending sports classes (including ice-hockey, skiing, track and field athletics, gymnastics and tennis)
5. Girls involved in sports classes (including gymnastics, skiing, handball and tennis).

The results indicated that in some sports (for example gymnastics) the somatotypes are homogenous, whilst in other sports the somatotypes are less homogenous. He stated that in top class athletes "a certain somatotype is a morphological pre-supposition" as, for example "field events and weight lifting". Heath and Carter (1986) compared two different methods of somatotyping 23 males and 31 females aged between 14 and 22. The two methods used were the criteria of Sheldon and the Heath-Carter method. The conclusions of the study were that there was a greater difference between methods

for young females than young males. This is probably due to the lack of rating criteria for females in the Sheldon method.

Sobral et al (1986) investigated the relationships between physique, personality and strength with menarchial age of college women. The subjects were first year female physical education students at Lisbon University. One of the hypotheses of the investigation was "that early and late maturing girls differ with respect to several morphological traits. Regarding somatotype status, the former have been appointed to endomorphy, while late maturers are recognised as more ectomorphic" (Carter, 1981). The results from this study replicated the findings of Carter that late maturing girls are more ectomorphic than early maturing girls.

The literature would suggest that somatotype is dependent on body composition changes, and that normally a training regime affects the first component (endomorphy) and the third component (ectomorphy). Whilst the somatopsychic rationale has been challenged as too simplistic and out-moded by some (Wright, 1977; Selby and Calhoun, 1978). Tucker (1983) concluded that additional credence must be afforded the somatotype perspective which asserts that somatic factors (obesity, exercise and somatotype) play a critical role in psychological well-being.

It is evident from the writings of Harris (1973), that people engage in physical activities which best suit their physique. Sweeney (1985) found that marathon runners tended to have low levels of body fat and to be in the main ectomorphic in morphology. Gwyon (1985) found that ballet dancers in full time training were high on the meso-ectomorphic components.

2.2.1. Summary of Somatotype

The literature would indicate that an individual's physique predetermines the choice of sports participation. Bale Rowell and Colley (1985) and Sweeney (1985) postulated that marathon runners are ectomorphs. Harris (1978) has suggested that physique more than any other factor determines the choice of sports. Since the days of Sheldon (1947) the link between somatotype and personality seems to be an area of constitutional psychology which has been of little interest to the sports psychologists.

Investigations which have studied the application of the Heath-Carter somatotyping method have tended to use groups of subjects who are self-selecting (Parnell, 1958; Stepnicka, 1986; Sobral et al, 1986). There has been little attempt to classify the Heath-Carter method "normal" sedentary groups of subjects. There is a paucity of research literature that qualifies and quantifies somatotypes of people who engage in physical activities.

This study will somatotype "normal" sedentary adult women and investigate the effect of exercise on the three components of the Heath-Carter somatotype. Many investigators have measured changes in body composition, and in particular changes in body fat and lean body weight, due to participation in a vigorous exercise programme. This study will investigate the effects of a training regime on the three components and monitor the changes which occur in them.

The inter-relatedness between the Heath-Carter somatotype and personality traits of adult women has not been of much interest to other researchers. It would also be pertinent to the body of knowledge concerned with sports psychology that the relationship between somatotype and body image is investigated. This relationship between physique and body image needs to be explored

because individuals use their bodies as a frame of reference in many decision-making processes. Although Kane (1971) has investigated the relationship between personality and somatotype among physical education students, the similar relationship between the physique and personality of sedentary adult women has not been studied. The control group in the study will also enable the study to measure subtle changes in components of somatotype.

2.3. OVERVIEW OF PERSONALITY

The study of "personality" has intrigued man's observation of his fellow beings since the days of Ancient Greece. The word personality itself is derived from the word "persona", a mask, donned by Greek actors as they moved from role to role in theatre productions. The classical works by the great scholars Hippocrates, Plato and Aristotle, describe their observations on the patterns of man's variance in behaviour and attempt to predict how different men will react when confronted with the same situation. Hall and Lindzey (1978) state:

"An individual's personality is assessed by the effectiveness with which he or she is able to elicit positive reactions from a variety of persons under different circumstances. Personality can be used to describe by the observer a behavioural pattern, for example it could be said that a person could be:-

a) an aggressive personality,

b) a submissive personality, or

c) a fearful personality.

These describe the attributes or quality that is highly typical of the subject."

The varied behavioural patterns in which different men come to terms with other people or other problems are the very essence of personality.

It has been suggested that personality consists of the varied and yet typical efforts at adjustment that are carried out by the individual. On the one hand, personality can be equated to the unique or individual aspects of behaviour which designate those things about a person and distinguishes him from other people. A

simple definition would be that personality comprises what is most typical and deeply characteristic of an individual. From the observer's standpoint, personality can be defined by the way it is measured. Hall and Lindzey (1978) postulate that:- "Personality consists concretely of a set of scores or descriptive terms that describe the individual being, studied in terms of variables or dimensions that occupy a central position within the theory utilized". Personality can be defined only in terms of how the observer deems to measure the qualities that subscribe to the dimension of personality.

When one person is compared with another, an analytical process is put into motion. This act of comparison is comparing one person's quality or qualities with what is determined to be the norm for his group and highlight a person's individual "traits".

Guildford (1959) states:- "A trait is any distinguishable relatively enduring way in which an individual differs from others. 'Trait' is thus a very broad general term". A personality trait may be as inclusive as a general attitude of self-confidence, or as narrow as a specific habit, such as a conditional contraction in response to a sound. A personality trait is a particular quality of behaviour such as assertiveness or cheerfulness which characterises the individual throughout a wide range of his activities and is often consistent over a period of time. The individual's personality would be the sum of these traits, although it is more than a sum of separate qualities.

Cattell says:-

"Personality may be defined as that which tells what a man will do when placed in a given situation".

Most individuals, as a result of their development and present interactions with their environment, have achieved some sort of enduring personality structure which can be measured or appraised. The search for personality structure is a search for some unifying principle or characterisation that expresses the essential unity of the person as well as his uniqueness.

The measurement of personality or the attempt to assess "typical behaviour" is concerned primarily with overt observable responses. The measurement of personality poses a fundamental question; if personality is unique to the individual, can it be measured against common standards or criteria to give it meaningful interpretation? Most personality testing has been measured by the use of self-administered questionnaires which are inventories and attempt to classify individuals. The first inventory concerned primarily with assessing the individual was the Woodworth Personal Data Sheet. During World War II the United States Army wanted to detect soldiers who were likely to break down in combat. To subject each recruit to an individual psychiatric interview was not a practical proposition with so many individuals being processed. Woodworth made a list of symptoms which a psychiatrist would touch on in a screening interview. The list was presented as a questionnaire and the recruits duly filled in the appropriate spaces. Men who reported numerous symptoms were singled out for further in-depth interview. The test was valuable because it was able to detect maladjusted soldiers without the impossible task of having to interview each individual recruit.

At the present time a psychometrist would use personality tests to assess an individual's orectic characteristics; that is his non-cognitive, non-intellectual qualities. There is such a "plethora"

of personality tests available that the first definition of a test would be a standardised situation that provides an individual with a score. By standardised, it is meant that all the procedures of testing are stated in advance in such a way that all subjects are tested with the same questions in the same way. A test is standardised only if two test administrators working independently could obtain the same results with the same group of subjects. The second important term in the definition of a test is "score"; that is a numerical indication of a subject's performance. A score is needed instead of a description of how well a subject performs because of the precision which a score provides. It also allows us to differentiate between the scores of two subjects. The characteristics of a standardised assessment procedure could be summarised under the conditions:

(i) the stimuli to be used are identical for all respondents and are always presented in the same fashion.

(ii) there are available norms, or frequency distributions of responses, either formal or informal (intuitive), so that responses can be assigned to a specific place within an anticipated range.

(iii) there are useful personality and behaviour correlates of the responses to be observed.

These conditions suggest three dimensions that could be useful in characterising personality assessment procedures. The first condition concerns the variety of relevant responses made by the test taker and observed by the examiner, and might be termed the degree of response structure.

Most paper and pencil inventories such as the MMPI (Minnesota Multiphase Personality Inventory) can be regarded as rather highly

structured with respect to respondent behaviours, since the only responses to be made and observed are indications of 'true' or 'false' to a series of personal statements.

Rorschach's ink blot test, on the other hand, would be regarded as relatively unstructured in the present sense because the examiner generally observes and records a wide range of respondent behaviour and considers all of them to be relevant response material.

The second dimension on which assessment procedures differ is the degree to which published formal norms are available. Structured inventories, such as the MMPI, with a smaller range of relevant responses, more readily lend themselves to the development of formal norms. Projective techinques with a larger range of responses generally do not have formal norms available.

The third dimension is the usefulness of the instrument - that is the extent to which the test taker's response will permit understanding and prediction of some of his non-test behaviour.

The term "validity" is similar to usefulness, but it is more precise and refers to the existence of a demonstrated relationship between certain test responses and a particular non-test characteristic of the person. Thus the number of validities, or valid relationships that a test possesses, and the importance of these relationships determine the test's usefulness.

The position of an assessment instrument on each of these three dimensions is, to some degree, established by the method of construction of the instrument and more, particularly, to the method of selecting the stimuli. In general, there are three major approaches to, or strategies in, the construction of formal assessment devices:-

(1) rational-theoretical

(2) empirical

(3) internal consistency

(1) Rationally derived tests are developed by selecting or constructing stimulus materials that SEEM to tap the behaviour under investigation. A test might also be devised to be congruent with a particular theoretical view of personality, and it would assess concepts within that theory. The Blacky Pictures Test (Blum, 1950) best approximates according to Lanyon and Goodstein, a theoretically derived personality test.

(2) The basis for a test can be EMPIRICAL, i.e., there is an empirical basis for believing that the test should work in the manner described by the test author.

(3) A test might be developed on the basis of the <u>internal consistency</u> of the items, e.g. a fairly large number of test stimuli might be administered to a group of respondents, and those items where responses are closely related or inter-correlated, are assumed to tap the same psychological variable. Such statistically defined variables are then used as indices of personality functioning.

The two personality tests which fulfil the previously stated criteria are the Eysenck Personality Inventory and the Cattell Sixteen Personality Factor Questionnaire.

In the Eysenck Personality Inventory, Eysenck and Wilson confirm that, before it is possible to describe or measure personality, it is necessary to have some sort of model to represent it and some sort of concept to encapsulate that model's different aspects (Eysenck and Wilson, 1975). In Eysenck's case a review of the current literature (Eysenck, 1960) convinced him that

there was strong support for the view that there were two clear and signally important dimensions of personality:

(1) extraversion - intraversion, and

(2) neuroticism, emotionality or stability-instability.

Diagrammatically, Eysenck's model of personality is represented by two scales indicating extents of the two dimensions. These scales cross, defining four zones of basic personality tendency which are remarkably similar to the four 'temperaments' of the traditional Galen-Kant-Wundt scheme of personality which originated with the Ancient Greeks (Figure I). Eysenck and Eysenck (1964) maintain that:-

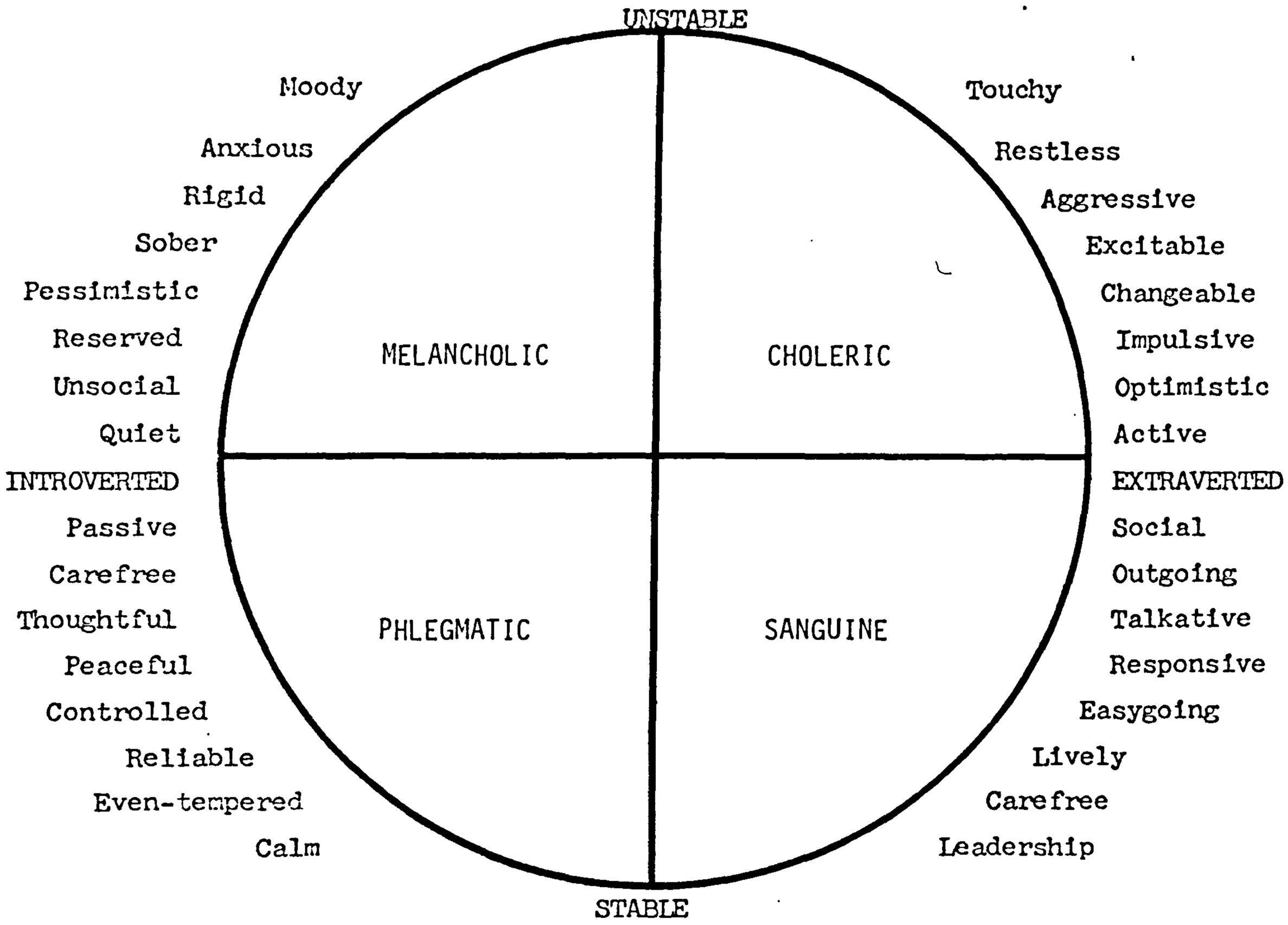
> "It is an empirical fact that a large proportion of the total common variance produced by the observed correlations between these traits ..... can be accounted for in terms of these two factors."

Cattell's scheme for testing personality, which is the major alternative to Eysenck's, has been found to give very similar results (Cattell and Scheier, 1961) and Guildford's personality studies have also resulted in second-order factors very close to those postulated by Eysenck.

The Eysenck Personality Inventory (EPI) (Eysenck and Eysenck, 1968) the form of Eysenck's test, is a development of the earlier Maudsley Personality Inventory (MPI) (Eysenck, 1959; Knapp, 1962), which had also measured degrees of extraversion and neuroticism. However, the EPI incorporated modifications rendering it more useful from a practical point of view.

(1) The EPI has two parallel forms; retesting after experimental treatment without memory factor interference is, therefore possible.

Figure 1



Eysenck Personality Inventory (EPI) - Graphic Representation of Factorial Dimensions of Extraversion-Introversion and Neuroticism-Stability

(2) The EPI items were reworded so as to be intelligible even to subjects of low levels of intelligence and/or education (many of the MPI items had been found too difficult for such subjects).

(3) There was a correlation between extraversion and neuroticism on the MPI which, though small, remained marginally significant; modified item selection removed it from the EPI.

(4) Unlike the MPI, the EPI includes a falsification scale which may be used to eliminate subjects exhibiting "desirability response set".

(5) The retest reliability of the EPI is higher than that of the MPI; even after several months it remains in excess of 0.85.

(6) Eysenck claims that direct evidence is available of the EPI's validity as a descriptive instrument of the behaviour manifestations of personality.

To summarise, the EPI measures two pervasive, independent dimensions of personality, namely Extraversion-Introversion (EX) and Neuroticism-Stability (NEUR). High EX scores are indicative of extraversion. High scoring individuals tend to be outgoing, impulsive and uninhibited, having many social contacts and frequently taking part in group activities. High NEUR scores are indicative of emotional inconsistency and over-reactivity. High scoring individuals tend to be emotionally over-responsive and to have difficulties in returning to a normal state after emotional experiences.

Cattell Sixteen Personality Factor Questionnaire

The important concept within Cattell's (1959) structural model of personality is the trait. By extensive empirical work he attempted to distinguish between source traits and surface traits. The source trait, which for Cattell is the fundamental stucture of personality, is an underlying variable which largely determines the overt variables that seem, to the observer, to go together. The apparent clusters of observable trait elements are termed surface traits. Surface traits are thought to be produced by the interaction of source traits with the stimulus situation, and hence surface traits are not stable.

In his primary investigations, Cattell obtained his raw data from numerous sources:

(1) life records (rating of individuals by trained observers)

(2) self completion questionnaires

(3) interviews

(4) performance.

The data was then factor analysed, which helped Cattell to identify source traits, for these traits are the major causal influences behind behaviour. Sixteen factors or dimensions which are relatively independent or uncorrelated are named by Cattell (Table). Thus, up to a certain point, the position occupied by an individual along one of these dimensions does not affect his position on any other dimension. Cattell (1965) further factor analysed his original specific behaviour measures to obtain second or higher order factors. These second order factors are described by Cattell as :-

> "These second order factors are typical organisers of primary factors, just as primary factors are in turn

TABLE 3 CATTELL'S SIXTEEN PRIMARY FACTORS (CATTELL, 1963)

HIGH SCORE DESCRIPTION	FACTOR	LOW SCORE DESCRIPTION
Outgoing,warmhearted,easy-going,participating (Cyclothymia)	A	Reserved,detached,critical, (Schizothymia)
More intelligent,abstract thinking bright (Higher scholastic mental capacity).	B	Less intelligent,concrete thinking (Lower scholastic mental capacity).
Emotionally stable,faces reality calm (Higher ego strength)	C	Affected by feelings,emotionally less stable,easily upset (Lower ego strength).
Assertive,independent,aggressive stubborn (Dominance)	E	Humble,mild,obedient,conforming (Submissiveness)
Happy-go-lucky,heedless,gay enthusiastic (Surgency)	F	Sober,prudent,serious, taciturn (Desurgency)
Conscientious,persevering,staid rule-bound (Stronger superego strength)	G	Expedient,a law to himself, by-passes obligations (Weaker superego strength).
Venturesome,socially bold,uninhibited,spontaneous (Parmia)	H	Shy,restrained,diffident, timid (Threctia)
Tender-minded,dependent,over-protected,sensitive (Premsia)	I	Tough-minded,self-reliant, realistic,no-nonsense(Harria)
Suspicious,self-opinionated, hard to fool (Protension)	L	Trusting,adaptable,free of jealousy,easy to get on with (Alaxia)
Imaginative,wrapped up in inner urgencies,careless of practical matters,bohemian (Autia)	M	Practical,careful,conventional regulated by external realities,proper (Praxernia).
Shrewd,calculating,worldly, penetrating (Shrewdness)	N	Forthright,natural,artless, sentimental (Artlessness)
Apprehensive,worrying,depressive troubled (Guilt proneness)	O	Placid,self-assured,confident, serene (Untroubled adequacy)
Experimenting,critical,liberal, analytical,free-thinking (Radicalism)	Q1	Conservative,respecting established ideas,tolerant of traditional difficulties (Conservatism)
Self-sufficient,prefers own decisions,resourceful (Self-sufficiency)	Q2	Group-dependent,a 'joiner' and sound follower (Group adherence)
Controlled,socially precise self-disciplined,compulsive (High self-concept control)	Q3	Casual,careless of protocol, untidy,follows own urges (Low integration)
Tense,driven,overwrought,fretful (High ergic tension)	Q4	Relaxed,tranquil,torpid,unfrustrated (Low ergic tension)

> organisers of specific pieces of behaviour. Naturally, these second order factors are broader in their influence than primary factors".

These second order factors complement Eysenck's work, for the same two fundamental dimensions of personality are defined. These are Extraversion-Introversion (or Exvia-Invia, as Cattell prefers to call it), and neuroticism (or anxiety, as Cattell calls it) and are labelled Q_1 and Q_2 in his system. The other two second order factors are labelled Q_3 and Q_4. The technical names are Q_3 "Pathemia" or emotional immaturity versus corticalertia; Q_4 is called Promethean will versus subduedness.

Eysenck (1965) suggests that there are only three major personality factors outside the cognitive field which present themselves as candidates for this searching type of analysis. These factors are EX (extraversion-introversion) and NEUR (neuroticism/emotionality) as opposed to stability and P (psychotism). He goes on to say that Cattell's work at the higher order end emerges with very similar factors.

2.3.1. Personality and Physical Activity

For the past twenty years the assumption that physical performance is a function of selected psychological traits has long been an issue of controversy. Morgan (1978) states that basically there are two personology camps, with many researchers claiming either a credulous or a sceptical view of the premise. The credulous claim that psychological data are useful for the prediction of performance, whilst the sceptics argue that is of little value.

Kroll (1970) is credited with the earliest comprehensive paper in the area of personality and sports performance. In Table Kroll listed five options which highlight the possibilities for a relationship between the dimension of personality and sport and physical activity. In 1976 Kroll was to contend that trait personality should be abandoned. Other researchers who have advocated this premise have included Martens (1975), Rushall (1970) and Singer et al (1977). They suggest that only clinical interpretations have been able to come up with anything like a definite conclusion, while studies with objective measurements of personality continue to offer conflicting results. Kane (1981) states:- "Considerable research has been undertaken but, on the whole, it has not produced coherent and unequivocal findings on which to rely for predictive purposes". Many of the criticisms of personality and physical activity have focussed attention on methodological inadequacies (Cooper, 1962), and in particular the inadequacy of operational definitions in many studies. Harris (1973) states that many of the reported investigations mirror the traditional classifications of sport and/or participation in an attempt to relate personality and performance. Many studies investigating personality and physical activity have used the following classification of subjects:-

(a) athletes vs non-athletes

(b) team and individual sportsmen

(c) athletes of differing abilities

(d) athletes from various subgroups.

Most of this research was conducted in the personality domain and sports psychologists have failed to control the factor of the multiple sport participants. The rugby or soccer player who would

TABLE 4

MODELS FOR THE POSSIBLE RELATIONSHIP OF PERSONALITY TO INVOLVEMENT IN SPORT AND PHYSICAL ACTIVITY

MODEL	DESCRIPTION
1. Common preliminary core	Those individuals with specific personality traits select and participate in specific sports.
2. Modification and Attrition	No common personality characteristics intially, but through modification and attrition only those individuals with suitable characersitics persist.
3. Common Initial Interests/ Dissimilar Final Interests	There is a common personality pattern among beginners but through participation and attrition, veterans possess dissimilar personality characteristics
4. Neophytes Opposite to Veterans	Veterans in sport possess personality traits which are completely opposite to rookies.
5. No relationship	Personality is unrelated to involvement in sport and physical activity.

Notes:

1. Popular stereotype which reflects this alternative is that extraverts select team sports while introverts show a preference for individual sports.
2. In this alternative sport beginners would be dissimilar in personality profiles but veterans would be similar.
4. Performance may result in dramatic changes in personality characteristics of an individual, to the extent that introverts may become extraverts to meet the requirements of the particular sport.

be classed as a team player in the winter may, in the summer, be a tennis player or track athlete, and would therefore be classed as an individual sportsman. No researcher has attempted to control this phenomenon or, on the other hand, established whether the multi sport participant differs from the individual who only participates in one sport.

The other major controversy which has flared up among sport psychologists has been the attack on trait theory. Trait theory is under attack not so much because it is an unsound theory, but because personality traits automatically emphasise the personal dispositions in explaining behaviour and minimise the role of situational factors. As a result, a number of alternative models and approaches have been proposed in an effort to explain a more vital and dynamic concept of personality sensitive to situational factors in behaviour. It was claimed by Martens (1975) that most sports psychologists had failed to distinguish between the old 'trait psychology' and the newer dispositional approach. The failure to make this distinction has been the most important conceptual problem in sport personality research; sports personologists have failed to recognise the importance of the environment of the immediate situation as a signficant determinant of behaviour. To predict behaviour more successfully, it is important to adopt an approach which considers the relationship between the individual's personality and the performance situation.

Kane (1981) proposes a number of alternative models and approaches in an attempt to define a more vital and dynamic concept of personality. The one most favoured is the interactional model which centres on the cognitive perceptions and interpretations of the person in a given situation. In the same paper Kane points out

that the increasing emphasis upon the person and the situation is completely consistent with the viewpoints of both Cattell and Eysenck. Morgan (1976) claims that it has been convincingly demonstrated that states and traits taken in concert will always account for more of the variance than either employed alone. The answers would seem to be not the trait or the situation but the interaction of the personality characteristics and the present situation that evokes behaviour.

Peterson et al. (1967) investigated the personality traits in women who participate in team sports and women who were involved in individual sports. The subjects were 38 women athletes of the 1964 United States Olympic Team. The individual sports included swimming, diving, riding, fencing, canoeing, gymnastics, and track and field events. The team sport subjects were from the teams who competed in the Women's AAO basketball finals. The Cattell 16PF was administered to the subjects and the results indicated that women who participate in individual sports are more dominant and aggressive, but are more introverted than women who participate in team sports.

Berger and Littlefield (1969), in a personality comparison of football athletes and non-athletes using the California Psychological Inventory, attempted to differentiate between athletes and non-athletes. Controlling for scholastic aptitude using the Scholastic Aptitude Test, they divided their sample into 30 outstanding football athletes, 30 non-outstanding football athletes and 30 non-athletes. They concluded that:- "....because of the multi- tudinous factors affecting personality which were not accounted for in this study, it is difficult to assess the effects of sports participation alone on personality."

Investigators have posed the question of whether various sub-groups of athletes differ because of their participation in respective sports or because they were different first and gravitated towards various sports because of inherent difficulties. Two studies have attempted to investigate this concept. Firstly, Lukehart and Morgan (1969) conducted a pilot investigation on junior high school males who had never participated in organised sports, in an attempt to evaluate whether athletes or non-athletes differ on personality dimensions from the outset. They administered the Junior Eysenck Personality Inventory to 33 males. Twenty one of these subjects subsequently elected to participate in football and eleven did not. Of those electing to participate in football, five were significantly more extroverted from the outset than the non-participants, but the two groups did not differ on the neuroticism scale. The groups were retested at the end of the season and were still found to differ on the extroversion dimension. As expected, neither group experienced a change in personality over a three month period.

Tattersfield (1971) conducted a five-year longitudinal study investigating the effect of the development of personality involved in a competitive environment. The subjects were 106 boys aged 12-14 years who were members of 223 swimming clubs throughout the North East. The competitive boys were each matched with a boy who was taking part in the normal physical education programme. The Cattell High School Personality Questionnaire and the Junior Eysenck Personality Inventory were administered annually to both groups. Both the competitive and control groups showed significant changes in total personality profile. Both groups significantly increased their scores on extraversion but the competitive group did not show

any significant changes on anxiety whilst the control group showed a significant gain. The competitive group showed no change in the level of independence, whilst the control group showed a significant change. The results of this study support those of Ryan (1958), Ogilvie and Tutko (1966) who have stated that personality is shaped through participation in competitive sport. The competitive group showed more marked personality changes than the control group in becoming more extrovert and less anxious.

Williams et al (1970), in a study of 30 national level female fencers using the 16PF and Edwards Personal Preference Study, found that the top level competitors were significantly more dominating than the low level competitors. They attempted to categorise the fencer as very reserved, self-sufficient, autonomous and individual with a below average desire for affiliation and nuturance.

A study by Schurr et al (1977) appeared to overcome the procedural and methodological problems. Described as a comprehensive, well designed, well analysed investigation, it tested 1956 males at college on Cattell's 16PF - both athletes and non-athletes. No single personaltiy profile distinguished athletes from non-athletes, yet when the athletes were categorised according to sports type, a number of interesting differences were observed. A number of findings conformed to 'traditional' or 'stereotypical' personality profiles for athletes. For example, team sport athletes were found to be more extraverted and more dependent than individual sport athletes; individual sport athletes were found to be less anxious and more independent and objective. The researchers questioned whether the results of previous studies would have been as inconsistent if, as in their study, 16PF second stratum factors had been emphasised.

A recent investigation by Tucker (1984) of the relationship between personality and performance enabled him to conclude that psychological traits, especially extraversion and body cathexis, are significant predictors of physical performance and that additional credence must be afforded the credulous viewpoint of the trait/performance controversy. Drawing from a conceptual framework based on Eysenckian Theory and the motivational properties of self-esteem it was hypothesised that extraverted, stable subjects with favourable self and body concepts would display the most strength in the lifting regime (weight lifting).

Adams and Botonchuk (1985) investigated the relationship between personality and somatotype. The subjects were one hundred males aged 17-29 who were somatotyped by the Heath-Carter Technique and were then administered the Cattell 16PF. A canonical analysis revealed significance between Factor L (protension) and ectomorphy, and endomorphy and Factor I (premsia) and global somato- tupe. Sweeney (1985) investigated the relationship between personality and marathon running using the Eysenck Personality Inventory. The findings of this study were similar to those of Morgan and Costill (1972) and Mikel (1983); i.e., that the requisite for good marathon performance was a low score on the NEUR scale. Gwyon (1986) investigated the effect of ballet training on the personality of adolescent females. Two groups of adolescent females engaged in full-time ballet training, and a group of non-dancers, were administered the Eysenck Personality Inventory. There were no differences in the personality characteristics of the dancers and non-dancers, but the dancers tended to have higher extraversion scores.

2.3.2. Personality and Physical Fitness

The changes in personality characteristics which may occur because of involvement in varying fitness regimes, have been of interest to sports psychologists. Using a young population, Tillman (1965) studied 386 senior boys and examined the personality traits of the top 15% and lower 15% of his sample. It should be noted that only the pull-ups and 600 yard run of the AAHPER Youth Fitness Test were used. For personality dimensions he employed Cattell's 16PF, the A-S Reaction Study of Allport and Kuder's Preference Record - Form C.

In terms of personality traits, Tillman found the upper 15% exhibited more dominance. He concluded that the physically fit were more extraverted. On Factor Q4 (composed versus tense) of the 16PF, the lower fitness group appeared to be tense, liking more accuracy and precision. He also found a difference in the ascendence-submission trait on the A-S Reaction Study. This, however, did not occur with Cattell's Factor E (submissiveness versus dominance).

On the basis of these findings, Tillman divided the lower group into two sub-groups; an experimental group who followed a strenuous physical fitness programme in addition to regular classes, and a control group who continued with their normal programme .After a nine-month physical fitness programme, which resulted in a signficant improvement in physical fitness, the experimental group was found to have changed significantly on only one of the 28 personality trait measurements, i.e. -1.81 on the clerical score of the Kuder Preference Record - Form C. A high score on this trait denotes interest.

Though Tillman demonstrated that subjects with a low standard of physical fitness tended to be tense, there is no agreement that

physical exercise has a direct effect on relaxation. Scott (1960) maintains that relaxation as a result of exercise depends on the type of exercise and the conditions in which it is undertaken. She suggests that physical exercise relieves other forms of stress. Michael (1978), on the other hand, theorises that regular daily exercise improves the organism's ability to withstand emotional stress through hormonal effects on the nervous system.

Brunner (1969), in an investigation into the motivating factors influencing adult participation in vigorous physical activity, collected data from 60 adults using the Adjective Check List and a questionnaire. The Check List consists of 300 adjectives which are descriptive of personality traits. His sample, with an average age of 38 years, was restricted to faculty, resident physicians and alumni businessmen at the University of Iowa.

Analysis of the data revealed significant personaltiy differences between the groups. He suggests that the stability of personality characteristics is more readily acceptable than the belief that personality is constantly changing. Consequently, he finds it reasonable to assume that the basic patterns are formed early in one's life.

Investigating the chronic effect of exercise, Jette (1971) retested 75 males who had participated eight years previously in one of Cureton's fitness programmes. He found significant differences between regular exercisers and non-exercisers in terms of albumin, bilirubin and serum alkaline phosphatase levels. Using a serum blood profile (SMA 12/60) and the 16PF, he noted that albumin, bilirubin and serum alkaline phosphatase levels were higher in irregular exercisers. Though he found it difficult to explain these observations, he hypothesised that the lower levels

of serum alkaline phosphatase might be indicative of the compressive or tensile effect of chronic physical activity on the skeletal system.

When comparing personality profiles of non-active subjects his results generally concurred with other researchers' findings. Habitual exercisers, he found, were less anxious than non-exercisers but, contrary to other findings, the non-exercisers in his study appeared more extraverted.

Ismail and Trachman (1971), in a study pertaining to the physiological and psychological status of 'normal' middle-aged men who participated in a four-month physical fitness programme, demonstrated that distinct personality differences exist between high- and low- fit individuals. Further, the data suggest that participation in a physical conditioning programme influences not only physiological parameters but also personality traits, particularly in the direction of emotional stability.

Young (1971), in a study of 50 such subjects using the 16PF Questionnaire, concluded that ".....personality may not be as rigid or permanent as formerly assumed. On certain dimensions subtle changes may occur as a result of increased physical fitness".

Ismail and Young (1973) compared univariate and multivariate results in identifying the best personality factors (16PF) for differentiating between two extreme physical fitness groups prior to, and at the conclusion of, a fitness programme. The univariate analysis was capable of differentiating between high and low fitness groups. Factors M and C were significant discriminators initially, while Factors O, Q_2 and M were significant finally. The multivariate analysis supported the univariate results and the

discrimination power of Factors C, M O and Q_2 was identified both initially and finally.

Young and Ismail (1973) investigated the nature and stability on the second- and third-stratum factor structures using orthogonal and oblique rotations of the physical fitness and personality data of 56 middle-aged male participants in a fitness programme. Orthogonal and oblique forms of solution were found to yield similar results. In general, the same factors were extracted both initially and finally, with some apparent modifications. The post-programme data analyses revealed that two factors were substantially loaded with physical fitness in contrast to only one initially, and it was clear that a shift in emphasis had taken place which may have been due to the treatment, namely the fitness programme. In one factor, the structure was dominated initially by physical fitness, while at the post-testing age, appeared to be the distinguishing characteristic, since the subjects become homogenous in terms of physical fitness. The analysis of the third-stratum factors, both initially and finally, again showed that the orthogonal and oblique forms of solution yielded similar results. Thus, the problem of rotation was not interesting and the hierarchial factor solutions were also highly stable.

Two distinct hierarchial factors were extracted from the initial data and were named Introversion vs Extraversion and Neuroticism vs Stablity. Of particular interest was the fact that physical fitness and its correlates, as observed in the second-stratum analyses, were found to be related to both third-stratum factors regardless of the forms of rotation. From the initial data it was concluded that physical fitness is related to personality

dimensions, especially at hierarchial levels (second and third strata).

Young (1979) investigated the effect of a ten-week exercise programme on the personality characteristics of 32 women subjects. The subjects were administered questionnaires which measured anxiety and depression. The subjects were then divided into groups on age, to form a young group and a middle-aged group. The middle-aged group showed significant improvement on anxiety and depression scores compared to the young group. Johnson et al (1984) investigated the effect of an aerobic dance programme on personality characteristics of university undergraduate females. The California Personality Inventory was used to measure personality, and significant improvements were found on psychological mindness and self control.

Clark et al (1986) investigated the effect of a twenty-four week jogging regime on thirty nine sedentary females aged 20-45 years. The subjects were psychologically tested pre-regime. The subjects were required to run three times per week for twenty minutes and were retested at the end of the twenty four weeks. The results indicated that there was a significant lowering of anxiety and a significant increase in a feeling of well-being.

Mutrie and Knill Jones (1986) investigated the psychological benefits of running in males and females participating in the 1984 Glasgow Marathon. All the respondents to the interviews and questionnaires reported psychological benefits from regular running which included relieved feelings of depression and reductions in feelings of anxiety and tension. The study highlighted the phenomenon that the most significant psychological benefits to be derived from running were perceived more frequently by the over 35 age group.

Moum (1988) investigated the effect of exercise on 2000 males and females who participated in an exercise regime on a regular basis. The subjects were given a questionnaire on two occasions over a two year period. All the subjects reported an increase in psychological well-being through participating in exercise.

Steptoe et al (1988) investigated the effect of a ten-week aerobic conditioning programme on 109 sedentary adult volunteers. The subjects were assigned to four groups; high intensity aerobic training, moderate intensity aerobic training, attention-placebo and waiting list. Psychological benefits were seen with the moderate exercise condition but not in the high exercise or attention placebo conditions. Mutrie (1988) investigated the effect of three different eight-week exercise programmes on depression, mood and fitness. The subjects were randomly assigned to three exercise groups; Group A received eight weeks of exercise with strengthening and stretching exercises introduced after four weeks. Group B received eight weeks of stretching and stengthening exercise with aerobic exercise introduced after four weeks. Group C had no treatment for four weeks and then received eight weeks of exercise which included aerobic, strengthening and stretching exercise. The psychological measures were the Beck Depression Inventory and the Profile of Mood States. All subjects reported that the aerobic exercises had the most significant effect on the reduction of depression.

2.3.3. Summary of Personality

This review of the pertinent literature would suggest that personality traits may be influenced through participation in sport. The changes in personality have been demonstrated among

younger children by Lukehart and Morgan (1969) and Tattersfield (1971). These studies clearly demonstrate that boys who participate in competitive sport, in the latter case for five years, are more extraverted than their non-participant colleagues. Participants in individual and team sports appear to differ in personality. Peterson et al (1967) and Schurr et al (1977) have shown that team sport participants are more extraverted and dominant. The criticism that Morgan (1978) made when reviewing these studies was that there was not an in-built control to monitor the multi-sport participant. In contrast, some authors (Berger and Littlefield, 1969) report that because of the many factors affecting personality, it is difficult to assess the effect of sports participation on personality.

Over the past decade the literature would seem to demonstrate that standards of physical fitness have a significant effect on personality traits. Tillman (1965) and Ismail and Young (1973) have shown that highly fit individuals are more extraverted than less fit individuals. Ismail and Trachman (1971) and Young (1971) have shown that subtle personality changes occur in people who participate in conditioning programmes. Many authors (Clark et al, 1986; Johnson et al, 1984; Mutrie and Knell Jones, 1986; Moum, 1988; Steptoe et al, 1988; Mutrie, 1988) have unequivocally demonstrated that participation in a vigorous exercise regime, and in particular aerobic activities, has psychological benefits such as an increased feeling of well-being and a reduction in anxiety.

This study will use the Eysenck Personality Inventory and the Cattell Sixteen Personality Questionnaire to determine the effects of participation in an exercise programme on the personality traits of adult women. There is little evidence pertaining to the effect

of physical exercise on personality, and that which does exist is related to young populations. Although Young and Ismail (1973) suggest that high fit and low fit men differ significantly in terms of emotional stability after participating in a conditioning programme, there is no evidence that female subjects would undergo similar personality changes.

The relationship between body image and personality has not been clearly demonstrated, and in particular the effect of participation in a conditioning programme has not been investigated. This study will examine the effects of exercise and the measurable concepts of an individual's manifest psychological orientation of personality and body image.

2.4. OVERVIEW OF EXERCISE

Over the past five years the exercise "boom" has developed in Great Britain. In our streets, day and night, one can see the jogger in any type of weather pounding the streets looking for the elixir of life. Exercise clubs and health clubs have mushroomed in cities and towns, offering diverse courses from aerobics to weight training, and the patrons flock to them in their "designer" exercise gear.

To accompany this, numerous books and videos have been produced, showing business personalities who claim that their exercise programme will enhance one's fitness and health. Much of the advice and books could be classed as disinformation because many people and exercise professionals have become confused about the risks and benefits which accrue from participation in a regular exercise regime. The mass of pseudo-scientific jargon which is at present part of the health and fitness scene has lead to the creation of "experts" whose knowledge about the science of exercise would be deemed questionable

A resume of the benefits of exercise would suggest that there are acute and chronic responses to the physiological systems of the body by involvement in exercise. The acute responses to exercise are the short term changes which take place during the exercise activity, for example:-

1. increase in heart rate
2. increased cardiac output
3. haematological responses
4. elevation of systolic blood pressure.

The chronic responses to exercise are the long-term changes associated with habitual physical activity and they include:-

1. cardiovascular adaptations, for example lower resting heart rate
2. metabolic adaptations
3. respiratory adaptations
4. body composition changes, in particular a loss of body fat.

The chronic responses to exercise are dependent upon a number of factors which include:-

1. the type of training activity
2. the frequency of participation
3. intensity of the programme (it is recommended that subjects should work at 70-80% of their maximum exercise heart rate)
4. the duration of each training session (a minimum of twenty minutes)
5. the duration of the exercise programme
6. the subjects initial level of fitness.

Pollock, Foster and Ward (1978), in a study conducted at the Mount Sinai Medical Centre in Milwaukee, suggest that exercise programmes of less than two days per week working for less than ten minutes and utilising less than 50% of the maximal oxygen uptake are inadequate for developing and maintaining fitness for healthy adults. They recommend an exercise prescription which would include an intensity of between 50% and 85% of maximal oxygen uptake, a duration of 15-60 minutes of near continuous activity, performed three to five days per week. Ashton and Davies (1986), in their book "Why Exercise" state that to develop cardiorespiratory fitness, dynamic exercises involving large muscle groups are required for maximum effect. They suggest that the best forms of exercise are running, jogging, cycling, swimming, rowing and brisk

walking. Ashton and Davies also state "there is no doubt that regular running/jogging is an excellent form of cardio-vascular exercise".

2.4.1. Women and Exercise

In general, the responses of females to exercise and training are basically no different than those of males. But as D H Harris (1973) says:- "For most females the avoidance of all risks involving participation in vigorous physical activities becomes the easiest route to follow. Conforming to the socially acceptable feminine image is a much safer practice". There have been numerous investigations conducted on the physiological changes, including both acute and chronic changes on the male athlete, but female athletes have not been as extensively studied.

Compared to the average adult male the adult female is:-

(1) 3-4 inches shorter

(2) 20-30 pounds lighter in body weight

(3) has 10-15 pounds more adipose tissue

(4) has 40-50 pounds less fat-free weight (mainly muscle, bone and organs).

Moody et al (1972) investigated the effect of a jogging programme on the body composition of normal and obese high school girls. Forty female subjects aged 16-18 years were divided into two groups (on the basis of 30% body fat), normal and obese. The subjects engaged in an exercise programme on four days a week for fifteen weeks. The obese group demonstrated significant reductions in body weight, relative fat and increases in body density and lean

body weight. Subcutaneous fat, as assessed by skinfold thickness, decreased markedly. The normal group showed no change in any of the body composition parameters other than skinfold thickness.

Gwinup (1975) conducted a study to investigate the effect of walking on eleven obese women. His findings indicated that no weight loss occurred until walking exceeded 30 minutes per day. When a certain amount of walking was maintained and weight stabilised at a lower level, more weight loss occurred when walking was increased. Smith and Stansky (1976) investigated the effect of training and detraining on the body composition of young women. Sixteen moderately active but untrained university students with an age range of 18-25 years volunteered to participate. The subjects were randomly assigned to an experimental group and a control group. The experimental group rode a bicycle ergometer three times per week for seven weeks. At the end of the exercise regime the experimental group's lean body weight had significantly increased whilst the control group remained stable. There was then a detraining period of seven weeks when the lean body weight returned to pretraining levels.

Lesmes et al (1976) using 32 untrained females aged 18-25 years undertaking different frequencies of training, found that the group which trained four days per week decreased body fat and increased their VO_2 approximately 20%. In a similar study Weltman et al (1976) used nineteen university female students; thirteen were the experimental group whilst the remaining six subjects were used as a control group. The experimental group trained three days per week for six weeks on a bicycle ergometer. The experimental group showed increases in their maximum oxygen uptake of 10.6% whilst the control group had similar scores pre and post treatment. Krahebuhl

et al (1978) used thirteen untrained sedentary female subjects aged 19-23 years. The physical training programme consisted of three one hour sessions per week for a total of sixteen hours. The programme consisted of 15-20 minutes of low intensity running and the remainder of the session was devoted to weight training. There was a slight increase in maximal oxygen uptake but no improvement in percentage body fat.

White and Young (1978) investigated the effect of a twelve week exercise programme consisting of jogging, calisthenics and recreational activities on cardio-respiratory function and body composition of 15 young and 15 middle-aged women aged 21-32 and 34-57 years respectively. The middle aged group showed a significant decrease in body fat whilst there was only a slight decrease for the young group. The cardio-respiratory variables showed that in the young group vital capacity increased significantly and submaximal heart rate decreased significantly, and resting and submaximal heart rates decreased in the middle aged group.

Rockefeller and Burke (1979) investigated the effect of a ten week aerobic dance programme on 21 college women aged 19-24 years. The subjects participated for three days per week for forty minute sessions. The results showed no significant decrease in body weight but there was a significant increase in maximum oxygen uptake.

Johnson et al (1984) investigated the effect of training frequency of aerobic dance on oxygen uptake and body composition. The subjects were 23 sedentary females aged 18-31 years enrolled in two aerobic dance classes. The subjects trained at 70% of their age related heart rate for 30 minutes in week one, and progressed to 90 minutes in the thirteen-week programme. Group 1 trained twice

weekly whilst Group 2 trained three times a week. Both groups exhibited significant decreases in percentage body fat and increased maximum oxygen uptake. The only difference between the two groups was that Group 2 displayed a greater decrease in percentage body fat.

Williams and Morton (1986) studied the effect of a twelve week aerobic dance programme on body composition and cardio-respiratory responses. The subjects were 25 sedentary females aged 18-30 years who trained three times per week for 45 minutes each session. Fifteen subjects from the same population acted as a control group; they maintained their normal activity and habits throughout the course of the study. At the end of the twelve-week programme the experimental group demonstrated increases in lean body mass and body density, together with decreases in percentage body fat and the sum of four skinfold thicknesses were all found to be significant. There were also significant improvements in submaximal heart rate and maximum oxygen uptake. No significant improvements in any of these variables were found for the control group.

Sedlock, Fitzgerald and Knowlton (1988) at a midwest university investigated the body composition and maximum oxygen uptake of a women's rugby squad consisting of nineteen subjects. The findings were similar to those reported for female participants in other sports in that they have less body fat and greater maximum oxygen uptake than physical education majors. This the authors attributed to the training regime; the rugby players involved themselves in mainly running and sprints. Vercruyssen and Shelton (1988) studied the intraseason body composition changes in collegiate female gymnasts. Eight national calibre subjects were measured pre-, mid- and post-season. The findings indicated that the most significant

change occurred from pre-season to post-season with up to 1.5 kg of body weight loss. On the other hand, percentage body fat decreased significantly from pre- to mid-season and mid- to post-season, the mean being equal from 21.4%, 17.4% and 13.4% respectively. The authors postulated that the most pronounced changes observed were decreases in subcutaneous body fat. This would suggest that significant decreases in body fat occur over a period of time more than actual body weight loss.

2.4.2. Summary of Exercise

The literature reviewed on the effect of exercise on women's body composition would appear to fall into two distinct dichotomies. On the one hand Moody et al (1975), Lesmes (1976), Johnson et al (1984) and Williams and Morton (1986) have shown that exercise regimes have the following effects on body composition; decreases in body fat and increases in body weight. On the other hand, Krahebuhl et al (1978) and Rockfeller and Burke (1979) showed that there were no body compositional changes among their subjects. These contradictory findings are due to the training regimes in which the subjects have participated. Pollock et al (1978) have demonstrated unequivocally that subjects who participate in exercise on a regular basis at least three times a week, at a training intensity of 60% of the training heart rate for at least ten weeks will show significant changes in body composition.

Many researchers have conducted their studies in North America, and only a few investigations have been conducted in England, and in the main among young people. This study will measure the effects of partipation in a controlled physical conditioning programme on sedentary adult women who live in north-west England. The programme

will have a content of vigorous aerobic activities including as graded jogging programme, and all subjects will be monitored during sessions to ensure that they are working at their own individual intensity.

The control group will be asked to maintain their normal activity and habits throughout the study. If physiological changes (i.e. increased fitness levels, decreased percentage body fat, increased lean body weight) are observed they can be attributed to participation in a conditioning programme. It will be possible to correlate the physiological changes in postural body image and personality, and also ascertain if similar psycho-physiological changes manifest themselves as those found by Young and Ismal (1973) among adult men in their Purdue Study. It will be of interest to see not only if males and females demonstrate psycho-physiological changes, but also whether different cultures react in a similar manner.

Null Hypotheses

Hypothesis I

There will be no significant differences of measures of postural body image, as measured by the Slade Russell Estimation Apparatus, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme.

Hypothesis II

There will be no significant differences of measures of postural body image, as measured by a novel apparatus (an Abacus), between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme.

Hypothesis III

There will be no significant differences of measures of somatotype, as measured by the Heath-Carter method, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme.

Hypothesis IV

There will be no significant differences of measures of personality, as measured by the Eysenk Personality Inventory and the Cattell Sixteen Personality Factor Questionnaire, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme.

SECTION 3

METHODS AND PROCEDURES

SECTION 3

METHODS AND PROCEDURE

3.1. Subjects

The subjects were 50 adult women who lived in the City of Liverpool with an age range of 18-37 years. All subjects were volunteers who were recruited through several adult education classes and by word of mouth.

During the recruitment procedure all subjects were asked if they would volunteer for a study investigating the relationship between exercise, body image and personality. They were informed that the testing would be on two occasions, would last for between one-and-a-half and two hours, and would be conducted on an individual basis. It was explained that the subjects would be assigned to two groups; an experimental group and a control group. The experimental group would take part in an exercise regime lasting for approximately one-and-a-half hours three times a week for twelve weeks. All testing was by appointment. Weekend and evening hours were made available so as not to discriminate against working women or mothers of small children. Subjects were offered a 15-minute feedback session with the experimenter at the end of the testing session to discuss the physiological data obtained. Subjects were assigned to either the control group or the experimental group on their willingness to take part in the exercise sessions on a regular basis for three months.

The demographic characteristics of the control and experimental group are shown in the Appendix . The two groups do not differ significantly in age, occupation or marital status.

3.1.1. Instrumentation and Procedure

The subjects were asked to come to the Human Performance Laboratory at Salford University. Each subject had been informed at the time of agreeing to participate that they would be undergoing a VO_2 max test (a full explanation of what this entailed had been given to each subject). Since Crisp and Klaucy (1974) have shown that food consumption affects the body image estimation of anorexic patients, it was decided to ask all subjects to refrain from eating for a period of 1.5 hours prior to testing. All subjects were tested in the same procedural way:-

1. Reception and preparatory test
2. Personality assessment questionnaires
3. Subjects then rested quietly in the supine position for 15 minutes
4. Body image assessment (Slade Body Size Estimation Apparatus)
5. Body image assessment (Abacus)
6. Real size measurement
7. Rest for 5 min supine position
8. Anthropometric measurements (including somatotype)
9. Ismail Fitness Criterion measurements.

3.1.2. Personality Assessment

To assess the subject's personality the following two personality questionnaires were used:-

1. The Eysenck Personality Inventory (Eysenck & Eysenck, 1964) was used to assess the introversion-extraversion and the neuroticism-stability of each subject.
2. Cattells (1970) 16 PF Questionnaire was used to obtain the following sixteen personality traits with their technical and popular titles as published:- (see overpage).

3.1.3. Postural Body Image Assessment

(1) Slade Russell Estimation Apparatus

The visual size estimation apparatus (SEA) adapted from Slade and Russell (1973) was used to measure the quantity and quality of postural body image distortion. The SEA consists of a horizontal bar supported on a tripod. The horizontal bar can move freely up and down enabling it to be fixed at a chosen height. The bar has two movable lights mounted on a calibrated track. The lights can be moved along the track by an electric motor controlled by depressing a manual control switch. The subject is asked to position these lights at a distance corresponding to her estimation of the width of her face, chest, waist and hips. The test is carried out in a darkened room with the subject standing 155 cm from the centre of the apparatus. The switch controlling the movement of the lights along the bar was held by the subject, eliminating the need to instruct the experimenter when the lights were in the desired position. This gave the subject maximum advantage in deciding where she wanted the lights to be, and it provided her the time to make that decision. The subjects were rested in the reclining position for 15 minutes prior to the test. Before testing the subjects were given the following instructions:-

	Trait or Factor Designation	Technical Title (Popular Title in Parentheses)
1	A	Schizothymia- versus- Cyclothymia (Aloof, Cold - versus - Warm, Sociable)
2	B	Low "g" - versus - High "g" (Dull, Low Capacity - versus - Bright, Intelligent)
3	C	Low Ego Strength - versus - High Ego Strength (Emotional, Unstable - versus - Mature, Calm)
4	E	Submissiveness - versus - Dominance (Submissive, Mild - versus - Dominant, Aggressive)
5	F	Desurgency - versus - Surgency (Glum, Silent - versus - Enthusiastic, Talkative)
6	G	Low Super Ego Strength-versus High Super Ego Strength (Casual,Undependable - versus - Conscientious,Persistent)
7	H	Threctia - versus - Parmia (Timid, Shy - versus - Adventurous, Thick Skinned)
8	I	Harria - versus - Premsia (Tough, Realistic - versus - Sensitive, Effeminate)
9	L	Inner Relaxation - versus - Protension (Trustful, Adaptable - versus - Suspecting, Jealous)
10	M	Praxernia - versus - Alaxia (Conventional, Practical - versus - Bohemian, Unconcerned)
11	N	Naivete - versus - Shrewdness (Simple, Awkward - versus - Sophisticated, Polished)
12	O	Confidence - versus - Timidity (Confident, Unshakable - versus - Insecure, Anxious)
13	Q_1	Conservatism - versus - Radicalism (Conservative, Accepting - versus - Experimenting, Critical)
14	Q_2	Group Dependence - versus - Self-Sufficiency (Dependent, Imitative - versus - Self-Sufficient, Resourceful)
15	Q_3	Low Integration - versus - Self-Sentiment Control (Lax, Unsure - versus - Controlled, Exact)
16	Q_4	Low Ergic Tension - versus - High Ergic Tension (Phlegmatic, Composed - versus - Tense, Excitable)

> All of us have a picture in our mind's eye of what our body looks like. I want to see what that picture is like for you. Try to imagine that you are standing facing a full length mirror. I want you to indicate your idea of this reflection by positioning the lights at a distance that corresponds to your idea of the WIDTH of the various parts of your body. I will call out the body part and you will move the lights so that the area between the points from light to the other light corresponds to the width of that part of your body. We will be repeating each part six times. Take as much time as you like.

Each site was measured six times; three times with the lights moving outward from the centre of the bar, and three times moving inwards from 100 cm apart, giving a total of 24 trials per subject. The height of the horizontal bar was adjusted to correspond with the height of the particular body size being measured. Each trial was recorded by the experimenter using a subdued torch to record the distance between the lights.

After the trials were completed the subject's actual body widths across the four body parts were measured using an anthropometer.

(2) Abacus - A Novel Body Width Dimension Self-Assessment Procedure

The postural body image of each subject was estimated by use of a novel body width dimension self-assessment measuring device, an abacus. This consisted of two six-foot stands with hooks screwed in an inch apart. Four rods with eight pointers (two on each rod) were

used to estimate the widths of the four body sites. The subjects stood at their arms length away from the horizontal rods which were then adjusted to the appropriate lengths of the subjects:-

1. Face (across the zygomas)
2. Chest (from axilla to axilla)
3. Waist (narrowest point)
4. Hips (widest point)

The subjects were then blindfolded and instructed to move the pointers to the widths of their four sites. The same procedure as using the SEA apparatus was followed; three times with the pointers moving outwards from the centre of the rods, and three times moving inwards from 100 cm apart, giving a total of 24 trials. Each estimate was recorded by the experimenter.

3.1.4. Somatotype

The assessment of the somatotype involved the following anthropomorphic measurements

1. Height (with shoes)
2. Weight (in shorts and tee shirt)
3. Muscle girth - biceps and calves
5. Skinfolds (using Holtain Caliper)

The sites selected were:

(1) biceps, over the mid point of the muscle belly with the arm resting on the subject's thigh;

(2) triceps, over the mid point of the muscle belly with the upper arm hanging vertically;

(3) subscapular, just below the tip of the interior angle of the scapula, at an angle of 45^{o} to the vertical

(4) suprailiac, just below the iliac crest in the mid auxilliary line;

(5) calf, over the mid point of the muscle belly with the foot resting on the floor.

The body fat percentage was estimated using the first four skinfold measurements using Durnin and Rhaman's tables (1967). All skinfold measurements were taken from the right hand side of the body with the subject seated upright on a stool.

A somatotype rating was calculated for each subject following the method modified by Heath and Carter (1968) using the Heath-Carter somatotype rating form.

Endomorphy (the first component) is assessed by summing three skinfolds; triceps, subscapular and suprailiac. The closest corresponding value on the F-scale is circled, and that column's rating circled and recorded.

Mesomorphy (the second component) - The subject's height is marked on the height scale. For each bone diameter, a figure is circled in the appropriate row which is nearest to the exact measurement. The triceps skinfold measurement is subtracted from that of the biceps girth, and the calf skinfold measurement subtracted from that of the calf girth, before circling the figure in the appropriate row which is nearest to the result of the subtraction in each case. Considering only the columns, the point which represents the mean of the circled values derived from the diameters and girths only is marked. The number of columns by which this mean value deviates, either to right or left, from the height marked initially is counted. One then moves that number of columns right or left from the four in the second component rating. The closest rating value is circled and recorded.

To obtain the third component, ectomorphy, 3/weight is found from a nomogram (Heath and Carter, 1968) and recorded by circling the closest value to the L-scale and the rating for that column is recorded.

The values for each component rating scale are recorded after 'anthropometrical somatotype' at the bottom of the form.

3.1.5. Ismail Fitness Score Measurements

Physical fitness scores were obtained for each individual based on the criterion of Ismail et al (1965). The criterion consists of six variables selected out of 52 collected items. The criterion was found to have a high predictive value when assessing physical fitness (R^2=0.881; R=939) they were:

1. Exercise pulse rate	-1.329
2. Percent lean body weight	4.880
3. Max O_2 uptake ml/kg lean body mass	2.502
4. Submax min vol vent/kg body weight	-119.017
5. Resting diastolic blood pressure	1.310
6. Resting pulse pressure	1.310
Constant	61.9

A variety of cardiovascular and respiratory variables were measured under various conditions demanded by the laboratory test protocol which consisted of:-

a) five minute rest period in reclining position

b) submaximal exercise task which involved a three minute warm-up exercise at 450 kpm on a bicycle ergometer (Monark, Sweden)

c) maximal exercise task involving incremental loads of 150 kpm each two minutes until age-related maximal heart rates were achieved.

d) cool down period of two minutes at 450 kpm

e) recovery period of two minutes in reclining position

Heart rates were determined electrographically and blood pressures using the standardised auscultatory technique at rest, during warm-up and exhaustive exercise conditions and following in the cool down and recovery phases.

Respiratory variables were measured during all stages of the exercise test (by using a Beckman Metabolic Measurement Chart) in order to determine maximal rate of ventilatory gas exchange in litres (VE_1) which, after analyses for the relative percentages of oxygen and carbon dioxide in the expired air, yielded the maximum oxygen uptake capacity per kilogramme of body weight (max $V)_2$ $ml.kg.mm^{-1}$). Thus max VO_2 is a measure of aerobic power or a measure of the capability for the delivery of oxygen supply to the working muscles by the cardio-respiratory systems, and as such, is the most often used measure of cardio-respiratory endurance fitnesss.

3.1.6. Exercise Conditioning Programme

The exercise programme was conducted at Huyton Leisure Centre for one-and-a-half hours three times a week, and was of twelve weeks duration. Depending on the individual's ability, the general description of the programme, in a sequential order, is as follows:-

1. Jogging for warm-up (10 min maximum)
2. Progressive calisthenics (35 min maximum)

3. Progressive running (15 min maximum)

4. Recreational activities (30 min maximum)

Following calisthenics in the sports hall, each individual ran for at least 0.5 mile. The distance varied according to the ability of the individual, and the distance range observed in the last three weeks of the programme was between 0.5 and 1.5 miles.

The recreational activities consisted of basketball, volleyball, swimming and tennis. Each of the subjects in the experimental group managed a 95% attendance at the exercise sessions.

SECTION 4

RESULTS

SECTION 4

RESULTS

The descriptive statistics for the physiological, psychological and body image variables for the two groups of subjects are presented in Tables 5-13. Statistical analyses were performed utilising the student's t-test with the appropriate numbers of degrees of freedom; significant changes in the various parameters measured pre- and post-conditioning programme are identified at the 0.05 level of significance. Furthermore, in order to assist the interpretation of the data, all results have been displayed in graphical form in Figures 2-24.

4.1. General Characteristics

The age, height, body weight, body composition and somatotype changes in the non-exercising and exercising groups are presented in Table 5 and Figures 2-10.

The non-exercising group tended to be slightly heavier in body weight and have more body fat than the exercising group in the pre-programme measures. However, the differences in weight and percentage body fat were not statistically significant. In the post measures, the exercising group lost body weight and percentage body fat and gained lean body weight, whilst there were no changes in the non-exercising group on these measures. These anthropometric changes in the exercising group were statistically significant.

The body weight and body fat changes during the conditioning programme are reflected in the changing pattern of somatotype ratings of endomorphy, mesomorphy and ectomorphy detailed in Figures 6-10. Initially, the non-exercising group showed a tendency

toward relatively higher endomorphy and lower mesomorphy ratings than the exercising group, but the differences between the two groups were not statistically significant. The post-conditioning programme results showed that the non-exercising subjects showed no changes in their endomorphy, mesomorphy and ectomorphy. The exercising group showed a trend towards a reduction in endomorphy rating which was significant at the $p<0.05$ level, as well as a tendency toward an elevated mesomorphy rating with little or no change in ectomorphy rating. Thus, in the exercising group, the post conditioning programme results showed a general pattern of body composition changes resulted in trends toward reduction of rotundness and the elevation of muscularity.

4.2. Ismail Fitness Score

The means, standard deviations and standard errors of the variables are multiplied by beta weights to give the criterion score. There were no significant differences between the two groups on the six variables, and consequently on the fitness score on the pre-programme scores. The post-conditioning programme results showed significant differences in decreasing scores on the variable "maximum oxygen uptake", and as a result there was a significant decrease in the Ismail Fitness Score ($p<0.05$). The exercising group demonstrated significant increases in the variable "maximum oxygen uptake" and the final Ismail Fitness Score for the group was significantly increased ($p<0.01$). There were no significant differences between the two groups at pre-programme on the Ismail Fitness Score; however, the post-programme results indicate there were significant differences between the non-exercising and exercising group, and the magnitude of the changes was

statistically significant ($p<0.01$). The results for the Ismail Fitness Score are shown in Table 6 and Figure 11.

4.3. Personality Data

The means, standard deviations and standard errors of the personality variables at the pre- and post-conditioning programme are presented in Tables 7-10 and Figures 12-20 respectively.

Higher mean values were observed on the neuroticism scale of the Eysenck Personality Inventory at both the pre- and post-programme tests for the non-exercising group. The mean values for the exercising group decreased from a mean of 11.28 to 9.64 at the conclusion of the conditioning programme, denoting greater emotional stability. For both groups the mean values for the extra-version scale of the EPI were almost identical, and the post-programme tests showed a slight decrease for both groups.

Comparable scores on the lie scale (psychotism) of the EPI were observed for both groups at pre- and post-programme tests.

The initial and final means, standard deviations and standard errors for both groups are presented in Tables 8-10, and are presented graphically in Figures 17-20 for the Cattell Sixteen Personality Questionnaire. No mean sten scores were observed on Factor A (aloof and cold vs. warm and sociable) at either pre- or post-programme testing. On both occasions the means for the non-exercising group indicated that it was the more stable of the two groups.

At both pre- and post-programme tests, the non-exercising group had above normal means on Factor B (dull vs. intelligent). The means of the exercising group were observed to be normal. Both

groups increased their post-test sten scores, from 6.52-7.00 and 5.36-5.88, respectively.

On Factor C (emotionally unstable vs. mature and calm) both groups at the pre-test had normal sten scores, but on the post-tests the exercising group showed a slight increase in their mean.

Both groups were found to be markedly more dominant and aggressive (Factor E) on their post-programme tests than their pre-tests.

On Factor F (glum and silent vs. enthusiastic and talkative) at the pre- and post-programme occasions, both groups had means above the norm, whilst the exercising group had a sten score of 6.04 at the pre-test, which was reduced to 5.56 at the post-test.

Both groups tended to have means below the test norm on Factor G (casual vs. conscientious), both initially and finally.

At both the pre- and post-programme the non-exercising group scored above average on Factor H (shy vs. adventurous) indicating an adventurous group. The exercising group at the pre-programme had a sten score of 4.76, which increased to 5.20 at the post-testing occasion, indicating that the treatment may have had an effect.

In the case of Factor I (tough and realistic vs. sensitive and effeminate) the mean of the non-exercising group was found to be within the normal range. The exercising group at the pre-test had a sten score of 5.16, which decreased to 4.84, an average score, on the post-programme testing.

On Factor L (trustful and adaptable vs. suspecting and jealous) both groups scored above average. This could possibly be attributed to the trauma of visiting the Human Performance Laboratory, an alien territory to all subjects.

The non-exercising group had higher means on Factor M (conventional vs. unconcerned) suggesting that they were slightly more unconventional than the exercise group, who were found to fall within the normal range in pre- and post-testings.

Both groups on Factor N (simple and awkward vs. sophisticated and polished) were found to fall within the normal range before and after the fitness programme.

The exercise group were observed to have a higher mean on Factor O (confident and unshakable vs. insecure and anxious) at the pre-test, but both groups had similar mean scores on the post-test, which were in the normal range.

On Factor Q_1 (conservative and accepting vs. experimenting and critical) both groups at the pre- and post-tests had above normal means for the norms of this test.

Above normal means are observed on Factor Q_2 (dependent vs. self-sufficient) for each group, both initially and finally.

On Factor Q_3 (lax and unsure vs. controlled and exact) similar mean values were observed for both groups (4.88 and 5.04), with relatively no change for the non-exercising group, but a slight decrease to 4.80 for the exercising group.

At the pre-test the non-exercising group had a high mean value of 6.52 on Factor Q_4 (phlegmatic and composed vs. tense and excitable) which only decreased slightly to 6.28 in the post-test.

On the other hand, the exercising group had an initial high mean value at the pre-test, but this had decreased significantly at the post-test, showing that they were more composed post-conditioning programme.

4.4. Body Image

A postural body image index for each part was obtained from the ratio:

$$\text{Body Image Index} = \frac{\text{Perceived Size}}{\text{Real Size}} \times 100$$

Perceived size was determined for each body by taking the mean of the six trials for the "Total" score and the mean of each of the the three Out Trials for the "Out" score, and the mean of the In trials for the "In" scores. The actual or "real size" of the body part was obtained by measuring the width of the four sites of the body with a calibrated caliper.

For the purpose of this study, accurate body size image (for both the SEA and Abacus) is defined as the sum index within the 90-110 range. Above 110 is defined as over-estimation and below 90 as under-estimation of body image. It has been assumed by Kessler (1978) that accurate body size is not a discrete point but rather a range. The convention established in defining normality in IQ testing is followed here, for if an index of only 100 was defined as accurate, discrimination between distortions and non-distortions would be lost. In this study the 90-100 index range has been accepted as the range of accuracy. The use of this range seemed reasonable for the purposes of this study, considering the findings of Blanchard (1975), Garner et al (1976) and Quinn and White (1978). In their study, Slade and Russell (1973) noted that all their control group subjects had estimated within this range, but that their group of anorexic subjects had estimated well outside, all their indices falling between 127 and 158.

The means, standard deviations and standard errors for the postural body image as measured by the SEA are presented in Table 12 and as histograms in Figures 21-22.

Overall, the body image indices in this study are essentially simiilar in both groups, and do not reveal any fundamental differences between them. On the three sites of Face, Chest and Waist, both pre- and post-programme tests demonstrated scores outside the accepted index range, except for the exercise group on the pre "Chest Out" trial, who displayed an accurate index of a mean value of 106.5, but this increased to 113.44 at the post-programme testing. On the "Hips" site, all subjects tended to have lower index mean scores on both pre- and post-programme testings. Again the exercising group had an accurate index score on their "Out" score, but this increased again slightly on their post-programme test. On all four sites all subjects pre- and post-programme had difficulty in estimating body widths when the lights were "ascending" (In) and high mean scores are recorded for the three sites of Face, Chest and Waist, but all subjects have lower body mean scores on their hips.

The means, standard deviations and standard error scores for the postural body image as measured by the Abacus are presented in Table 13 and as histograms in Figures 23-24.

All subjects on their "Face" site tended to have high mean values which were outside the accuracy index on all trials.

On the Chest site, the non-exercising group had high mean values on their pre- and post-programme tests on their Total Body Index, but on their "Out" scores were within the accuracy index. The exercising group, on the Total Index and the Out means, were

within the accuracy range. Both groups again had a tendency to over-estimate their chest widths on the ascending trials.

Both groups had similar scores on the Waist Total scores, but again on the Out scores the non-exercising group were just within the accuracy index, but the exercise group had lower mean values of 98.17 and 104.8 respectively.

The pre- and post-programme tests for both groups on the Hips Total and Hips Out were within the accepted mean values but again both groups were more accurate in their estimation scores on the Out trials.

On all four sites all subjects had difficulty in estimating body widths; when they were asked to bring the pegs inwards they scored high over-estimation scores similar to the SEA scores.

4.5. Distortion of Body Image

It was hypothesised that in comparison to a group of subjects who attended an exercise conditioning programme, a non-exercising group would have a less accurate postural body image; that they would perceive their body width as being narrower or wider than it actually is. Thus, it would be expected that the magnitude of distortion as measured on the SEA and Abacus would be greater for the non-exercising group than for the exercising group, and that the non-exercising group would have a less well-articulated postural body image as indicated by the range of the individual scores on the SEA and Abacus.

The means and standard deviations of the distortion scores for each body part for non-exercising and exercising subjects are shown in Table 14. The mean distortion scores for each body part were summed to obtain the sum of the means. In this calculation the

direction of the distortion was taken into account, i.e., if the distortion was in the direction of an over-estimation it was assigned a plus score, and if it was in the direction of an under-estimation it was assigned a minus score. The sum of the means was therefore affected by the addition of signs.

In order to obtain a measure of the total amount of distortion regardless of whether it was an under- or over-estimation, the magnitude of distortion was calculated. This consisted of the sum of the means of the distortion scores ignoring sign.

A range score for each body part of each subject was calculated by taking the difference between the highest and the lowest responses over the eight trials. The sum of the range was obtained by summing the range scores of each body part for each subject.

In Table 14 the means, standard deviations and standard error scores for both groups as measured by the SEA are shown. The Direction of Distortion means for the non-exercising group are higher at the pre- and post-programme tests than those of the exercising group. Both groups at the post-programme test decreased their means on all four sites.

The Range of Distortion means on the Face site were similar for both groups at the pre- and post-programme tests. On the three sites of Chest, Waist and Hips, the non-exercising group had higher mean scores at the pre- and post-programme tests than the exercising group. Again it was observed that both groups decreased their mean values at the post-programme test.

The Range Scores for both groups were significantly decreased at the post-programme tests, with the non-exercising group showing the greater decrease in their mean value.

TABLE 5 GENERAL CHARACTERISTICS OF THE NON-EXERCISERS AND EXERCISERS, PRE AND POST CONDITIONING PROGRAMME.

Anthropometric	Non-Exercisers(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
	X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
Age (years)	24.84	5.09	1.02	26.0	5.33	1.06	25.16	5.24	1.04	26.08	5.29	1.05
Height (cms)	162.67	4.52	0.9	162.32	5.53	1.10	162.66	4.53	0.9	162.32	5.53	1.10
Weight (kgs)	59.73	7.28	1.45	57.72	6.10	1.22	59.78	7.35	1.47	56.78	5.85	1.17
Percent Body Fat (est)	27.09	4.40	0.88	25.17	3.85	0.77	27.51	4.51	0.90	24.61	4.13	0.82
Lean Body Weight (kg)	42.98	4.27	0.85	43.1	3.83	0.76	43.06	3.80	0.76	42.17	3.54	0.70
Endomorphy	4.72	1.33	0.25	4.02	1.02	0.20	4.72	1.32	0.26	3.80	1.02	0.20*
Mesomorphy	4.64	0.78	0.15	4.80	0.65	0.13	4.66	0.83	0.16	4.90	0.93	0.18
Ectomorphy	2.30	1.20	0.24	2.34	0.71	0.14	2.38	1.14	0.22	2.36	0.64	0.12

TABLE 6 PHYSICAL FITNESS SCORES BASED ON THE ISMAIL ET AL. CRITERION PRE- AND POST-CONDITIONING PROGRAMME

VARIABLE	Non-Exercisers(Pre) X	SD	±SE	Exercisers(Pre) X	SD	±SE	Non-Exercisers(Post) X	SD	±SE	Exercisers(Post) X	SD	±SE
Exercise Heart Rate	178.12	10.16	2.0317	177.68	9.286	1.857	174.88	13.41	2.68	179.92	8.83	1.77
% Lean Body Weight	72.94	4.496	0.899	75.044	3.987	0.797	72.484	4.09	0.92	75.264	4.14	0.828
Max Oxygen Uptake	42.845	6.826	1.365	44.880	5.074	1.015	39.575	6.84	1.37*	53.64	6.08	1.22*
Submax Minute Volume of Ventilation	0.3812	0.071	0.014	0.451	0.146	0.029	0.437	0.187	0.038	0.429	0.08	0.016
Resting Diastolic Blood Pressure	75.72	10.90	2.180	77.04	7.497	1.499	79.32	7.233	1.447	72.44	8.756	1.751
Resting Pulse Pressure	42.76	10.80	2.16	46.40	8.79	1.758	41.48	9.597	1.919	49.96	9.163	1.833
Fitness Score	196.05	43.63	8.73	208.60	34.14	6.83	176.86	40.679	8.136**	239.61	35.745	7.150***

TABLE 7 PSYCHOLOGICAL CHARACTERISTICS OF NON-EXERCISING AND EXERCISING WOMEN PRE AND POST CONDITIONING PROGRAMME

EYSENCK EPI	Non-Exercisers(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
	X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
Neuroticism - Stability	12.32	3.99	0.79	11.28	3.72	0.74	10.52	3.89	0.77	9.64	3.84	0.76
Introversion - Extraversion	13.88	4.56	0.91	13.48	3.96	0.79	11.76	3.69	0.73	11.36	3.95	0.79
Psychotism	2.28	1.24	0.24	2.44	0.75	0.15	2.24	1.06	0.21	2.28	1.04	0.20

TABLE 8 PSYCHOLOGICAL CHARACTERISTICS OF EXERCISING AND NON-EXERCISING WOMEN IN PRE AND POST CONDITIONING PROGRAMME

CATTELL 16PF	Non-Exercisers(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
VARIABLE	X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
A	4.88	1.58	0.31	5.16	1.51	0.31	4.60	1.91	0.38	4.80	1.72	0.34
B	6.52	1.52	0.30	5.36	1.95	0.39	7.00	1.52	0.30	5.88	1.94	0.38
C	5.32	1.46	0.29	5.60	1.62	0.32	5.40	1.32	0.26	5.96	1.42	0.28
E	5.88	2.48	0.49	5.72	2.32	0.46	6.60	2.56	0.51	6.44	2.08	0.41
F	5.60	1.64	0.32	6.04	1.48	0.29	5.68	1.64	0.32	5.56	2.00	0.40
G	4.56	1.38	0.27	4.36	1.41	0.28	4.56	1.60	0.32	4.52	1.94	0.38
H	5.16	1.48	0.29	4.76	1.68	0.33	5.20	1.67	0.33	5.20	1.74	0.34
I	4.16	1.82	0.36	5.16	1.82	0.37	4.84	1.97	0.39	4.84	1.91	0.38
L	6.44	1.38	0.27	6.28	1.24	0.24	6.76	1.27	0.25	6.00	2.05	0.41
M	5.36	1.49	0.29	4.96	1.53	0.30	5.60	1.78	0.35	4.76	1.17	0.23
N	5.76	2.00	0.40	5.76	1.60	0.32	5.52	1.74	0.34	5.40	1.78	0.35
O	4.80	1.69	0.33	5.48	1.52	0.30	4.96	1.98	0.39	4.92	1.89	0.37
Q1	6.64	1.64	0.32	6.64	1.87	0.37	6.88	1.63	0.32	6.48	2.17	0.43
Q2	5.64	1.69	0.33	5.08	2.11	0.42	5.84	1.78	0.35	5.36	2.41	0.47
Q3	4.88	1.60	0.32	5.04	2.04	0.40	4.76	1.65	0.33	4.80	1.76	0.35
Q4	6.52	1.20	0.24	6.04	1.58	0.31	6.28	1.61	0.32	5.56	1.49	0.29

TABLE 10 . SIXTEEN PERSONALITY FACTOR QUESTIONNAIRE (16PF)

	LOW SCORE DESCRIPTION	STEN SCORE 1 2 3 4 5 6 7 8 9 10	HIGH SCORE DESCRIPTION	
A	Aloof, Cold		Warm, Sociable	A
B	Dull, Low Capacity		Bright, Intelligent	B
C	Emotional, Unstable		Mature, Calm	C
E	Submissive, Mild		Dominant, Aggressive	E
F	Glum, Silent		Enthusiastic, Talkative	F
G	Casual, Undependable		Conscientious, Persistent	G
H	Timid, Shy		Adventurous, "Thick Skinned"	H
I	Tough, Realistic		Sensitive, Effeminate	I
L	Trustful, Adaptable		Suspecting, Jealous	L
M	Conventional, Practical		Bohemian, Unconcerned	M
N	Simple, Awkward		Sophisticated, Polished	N
O	Confident, Unshakable		Insecure, Anxious	O
Q1	Conservative, Accepting		Experimental, Critical	Q1
Q2	Dependent, Imitative		Self-sufficient, Resourceful	Q2
Q3	Lax, Unsure		Controlled, Exact	Q3
Q4	Phlegmatic, Composed		Tense, Excitable	Q4

------ POST NON EXERCISE ——— POST EXERCISE

TABLE 9 . SIXTEEN PERSONALITY FACTOR QUESTIONNAIRE (16PF)

	LOW SCORE DESCRIPTION	STEN SCORE 1 2 3 4 5 6 7 8 9 10	HIGH SCORE DESCRIPTION	
A	Aloof, Cold		Warm, Sociable	A
B	Dull, Low Capacity		Bright, Intelligent	B
C	Emotional, Unstable		Mature, Calm	C
E	Submissive, Mild		Dominant, Aggressive	E
F	Glum, Silent		Enthusiastic, Talkative	F
G	Casual, Undependable		Conscientious, Persistent	G
H	Timid, Shy		Adventurous, "Thick Skinned"	H
I	Tough, Realistic		Sensitive, Effeminate	I
L	Trustful, Adaptable		Suspecting, Jealous	L
M	Conventional, Practical		Bohemian, Unconcerned	M
N	Simple, Awkward		Sophisticated, Polished	N
O	Confident, Unshakable		Insecure, Anxious	O
Q1	Conservative, Accepting		Experimental, Critical	Q1
Q2	Dependent, Imitative		Self-sufficient, Resourceful	Q2
Q3	Lax, Unsure		Controlled, Exact	Q3
Q4	Phlegmatic, Composed		Tense, Excitable	Q4

-------- PRE NON EXERCISE ———— PRE EXERCISE

TABLE 11 ACTUAL MEASURED BODY SIZES OF EXERCISERS AND NON-EXERCISERS

	NON-EXERCISERS			EXERCISERS		
	X	SD	SE	X	SD	SE
Face	12.81	0.54	0.1	13.02	0.66	0.13
Chest	26.0	2.09	0.41	27.03	1.30	0.26
Waist	24.06	2.20	0.44	23.95	1.44	0.28
Hips	33.02	1.80	0.36	32.59	1.66	0.33

TABLE 12 SLADE RUSSEL APPARATUS

Body Image Characteristics of Non-Exercisers and Exercisers, Pre- and Post-Conditioning Programme

VARIABLES		Non-Exerciser(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
		X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
FACE	Total	137.46	18.46	3.69	127.92	24.23	4.84	131.75	21.47	4.29	128.74	13.01	6.02
	Out	124.12	17.24	3.44	117.07	22.51	4.50	128.50	20.81	4.16	125.07	27.72	5.54
	In	150.75	24.96	4.99	138.75	27.57	5.51	135.04	24.56	4.91	132.39	33.38	6.67
CHEST	Total	130.44	17.53	3.50	116.48	16.24	3.24	124.34	16.63	3.32	114.87	13.87	2.77
	Out	117.89	17.78	3.55	106.54	14.92	2.98	119.22	15.39	3.07	113.44	14.60	2.92
	In	143.06	19.72	3.94	126.40	19.66	3.93	128.76	20.44	4.08	116.34	14.31	2.86
WAIST	Total	132.53	14.06	2.81	120.86	14.07	2.81	124.97	12.48	2.49	121.43	12.12	2.42
	Out	122.63	16.26	3.25	114.42	15.85	3.17	122.21	12.06	2.41	119.71	12.76	2.55
	In	142.35	14.42	2.88	127.33	15.46	3.09	127.73	15.13	3.02	123.16	13.26	2.26
HIPS	Total	119.88	12.68	2.53	113.26	15.15	3.03	113.87	10.44	2.08	112.03	12.53	2.50
	Out	111.48	14.01	2.80	106.87	14.76	29.5	109.99	9.74	1.94	111.70	13.09	2.61
	In	128.77	13.79	2.75	119.67	17.52	3.50	117.76	12.90	2.58	112.33	13.13	2.62

TABLE 13 ABACUS

Body Image Characteristics of Non-exercisers and Exercisers, Pre- and Post-Conditioning Programme

VARIABLES		Non-Exericiser(Pre)			Exerciser(Pre)			Non-Exerciser(Post)			Exerciser(Post)		
		X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
FACE	Total	175.95	25.87	5.17	152.02	28.47	5.69	170.66	26.67	5.33	161.31	39.53	7.90
	Out	144.84	29.7	5.94	123.22	25.18	5.03	153.33	29.34	5.86	141.08	41.53	8.30
	In	206.70	31.32	6.26	180.70	39.31	7.86	188.02	33.76	6.75	181.55	41.24	8.24
CHEST	Total	117.35	18.78	3.75	107.64	11.67	2.33	116.47	17.07	3.41	109.44	16.95	3.39
	Out	105.17	18.45	3.69	93.90	16.65	3.33	108.57	17.15	3.43	100.98	19.92	3.98
	In	129.51	24.26	4.85	121.26	12.42	1.87	124.34	21.64	4.32	117.89	17.71	3.54
WAIST	Total	121.08	16.02	3.20	115.95	15.64	3.12	120.30	17.50	3.50	116.23	19.70	3.94
	Out	107.11	18.09	3.61	98.17	21.19	4.23	111.35	18.09	3.61	104.82	23.25	4.65
	In	135.05	20.36	4.07	133.74	17.47	3.49	129.14	21.46	4.29	127.66	20.85	4.17
HIPS	Total	110.80	14.94	2.98	109.61	10.56	2.11	111.32	14.87	2.97	113.39	13.33	2.66
	Out	96.96	14.95	2.99	95.63	15.55	3.11	102.94	13.99	2.79	100.54	15.92	3.18
	In	121.45	13.34	2.66	123.60	12.55	2.51	119.68	17.97	3.59	126.50	13.58	2.71

TABLE 14 SLADE RUSSELL APPARATUS

DIRECTION OF DISTORTION SCORES, MAGNITUDE OF DISTORTION SCORES, RANGE SCORES.

	Non-Exercisers(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
	X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
DIRECTION OF DISTORTION												
Face	28.65	13.50	2.7	23.59	19.84	3.96	24.48	16.63	3.3	20.35	21.1	4.22
Chest	46.64	25.14	5.02	28.50	25.36	5.07	34.66	22.14	4.42	24.31	23.06	4.61
Waist	45.47	21.83	4.36	31.91	19.94	3.98	35.62	17.39	3.47	31.06	16.78	3.35
Hips	38.69	25.21	5.04	28.49	27.74	5.54	27.34	20.11	4.02	23.34	24.79	4.95
RANGE OF DISTORTION												
Face	28.91	13.44	2.68	27.33	14.66	2.93	24.86	15.91	3.18	26.15	18.01	3.6
Chest	49.47	21.65	4.33	35.31	17.36	3.45	38.2	21.65	4.33	30.2	15.34	3.06
Waist	46.69	20.35	4.07	34.35	17.36	3.47	36.19	16.34	3.26	32.1	15.56	3.11
Hips	42.66	21.18	4.23	34.35	21.84	4.36	31.18	15.87	3.17	29.75	17.16	3.43
RANGE SCORE	29.3	11.41	2.28	20.4	15.06	3.01	18.82	8.01	1.6*	15.32	10.13	2.02*

TABLE 15 ABACUS APPARATUS

DIRECTION OF DISTORTION SCORES, MAGNITUDE OF DISTORTION SCORES, RANGE SCORE.

	Non-Exercisers(Pre)			Exercisers(Pre)			Non-Exercisers(Post)			Exercisers(Post)		
	X	SD	±SE	X	SD	±SE	X	SD	±SE	X	SD	±SE
DIRECTION OF DISTORTION												
Face	58.26	19.70	3.94	41.20	22.58	4.51	55.18	19.93	3.98	46.82	29.75	5.95
Chest	25.80	29.07	5.81	12.60	18.45	3.62	24.57	25.42	5.08	14.98	26.93	5.38
Waist	31.77	22.35	4.47	23.94	21.58	4.31	30.27	24.80	4.96	22.95	28.37	5.67
Hips	20.70	25.59	5.11	18.39	20.89	4.17	23.50	29.13	5.82	25.59	26.71	5.34
RANGE OF DISTORTION												
Face	59.16	18.84	3.76	43.88	18.71	4.74	55.37	19.81	3.96	49.54	26.31	5.26
Chest	38.47	17.06	3.41	32.21	10.46	2.09	33.10	17.05	3.41	32.71	12.45	2.49
Waist	38.70	17.99	3.59	39.32	11.87	2.37	37.34	18.04	3.60	36.80	19.64	3.92
Hips	38.72	16.60	3.32	39.01	11.52	2.30	35.40	21.54	4.30	41.68	14.08	2.81
RANGE SCORE	33.10	19.02	3.80	24.80	16.13	3.23	31.21	16.56	3.31	27.89	20.25	4.05

FIGURE 2 General Characteristics of the Non-Exercisers and Exercisers Pre- and Post-Conditioning Programme

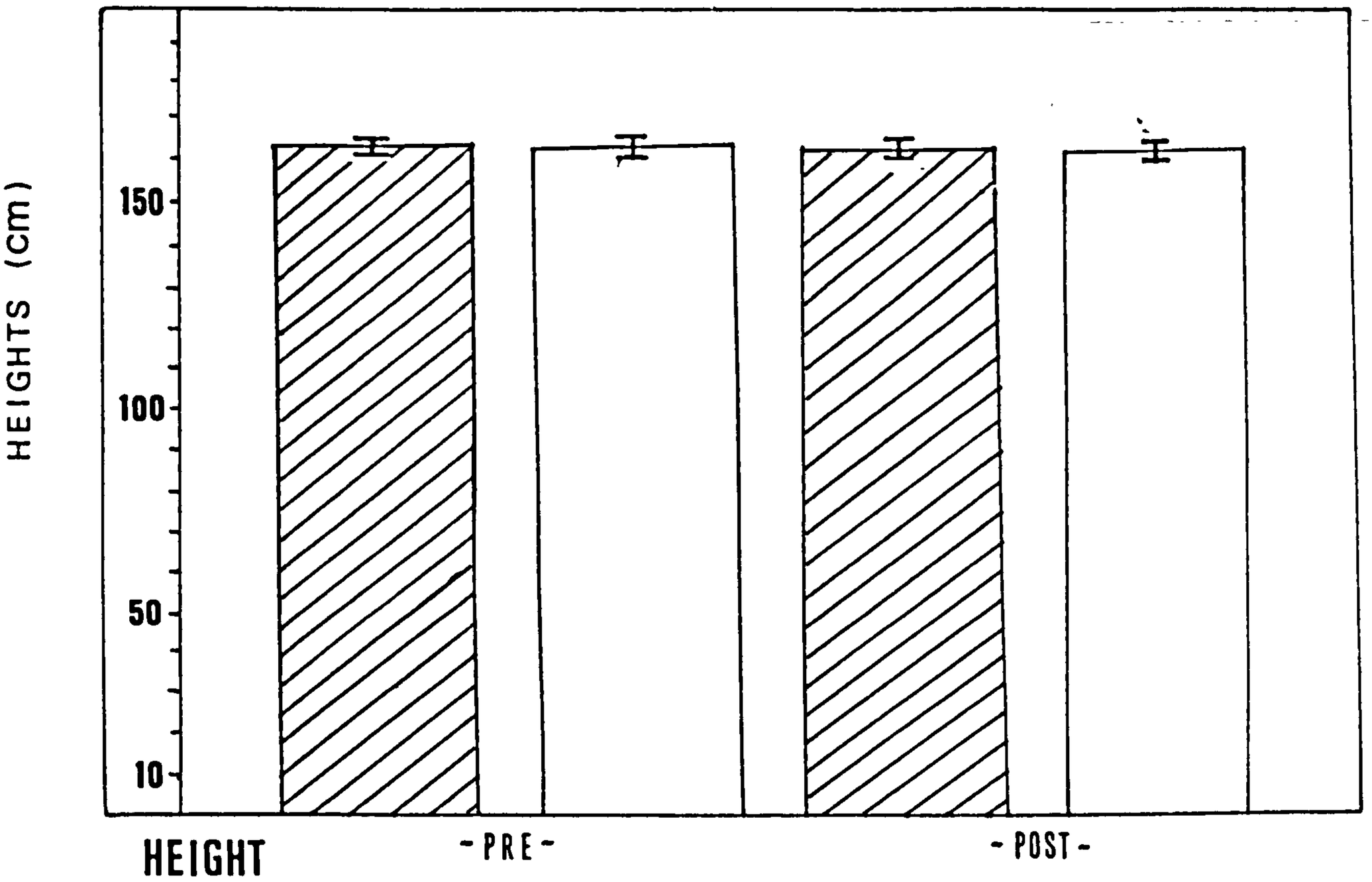


FIGURE 3 As above - Weight

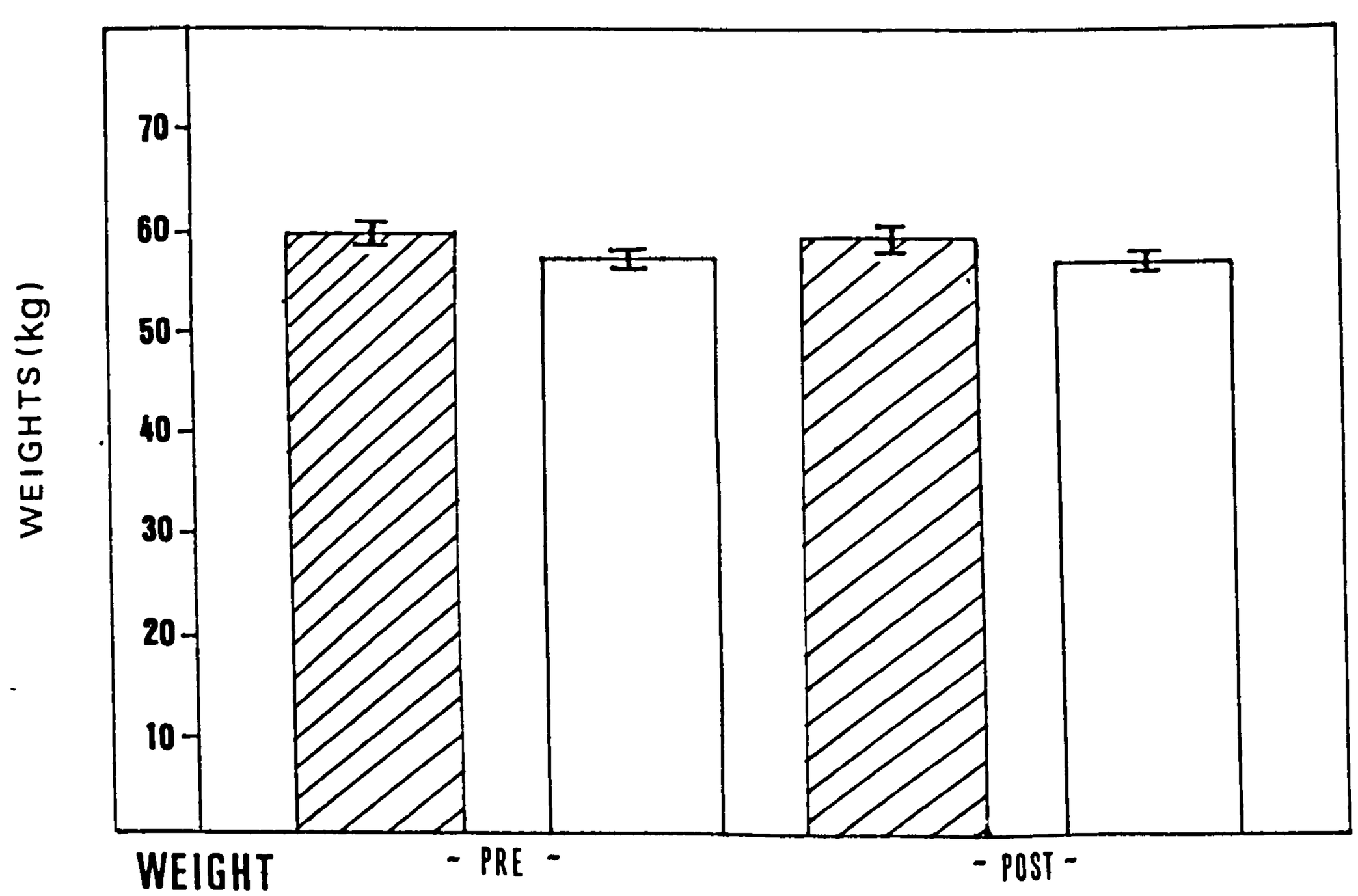


FIGURE 4

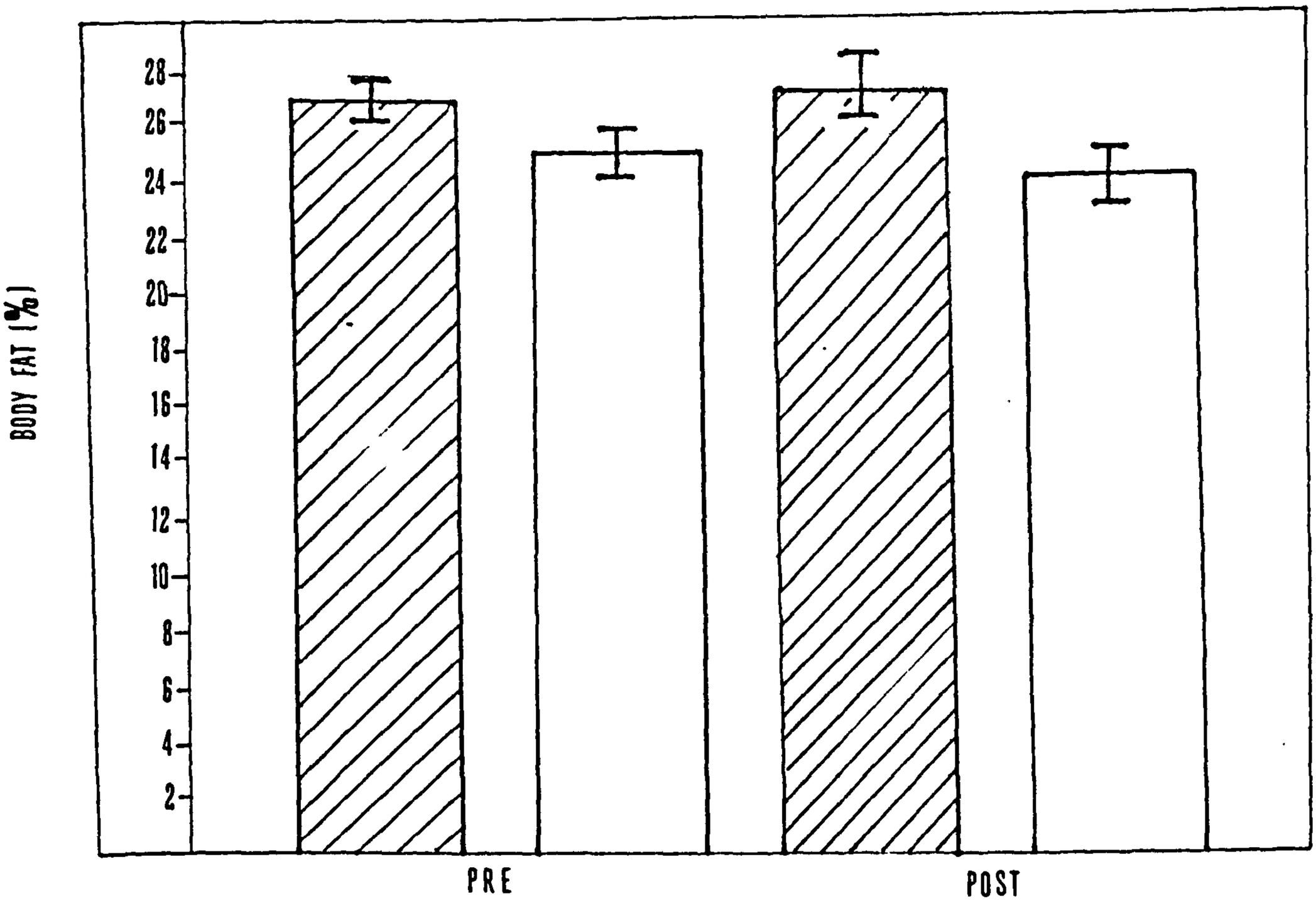
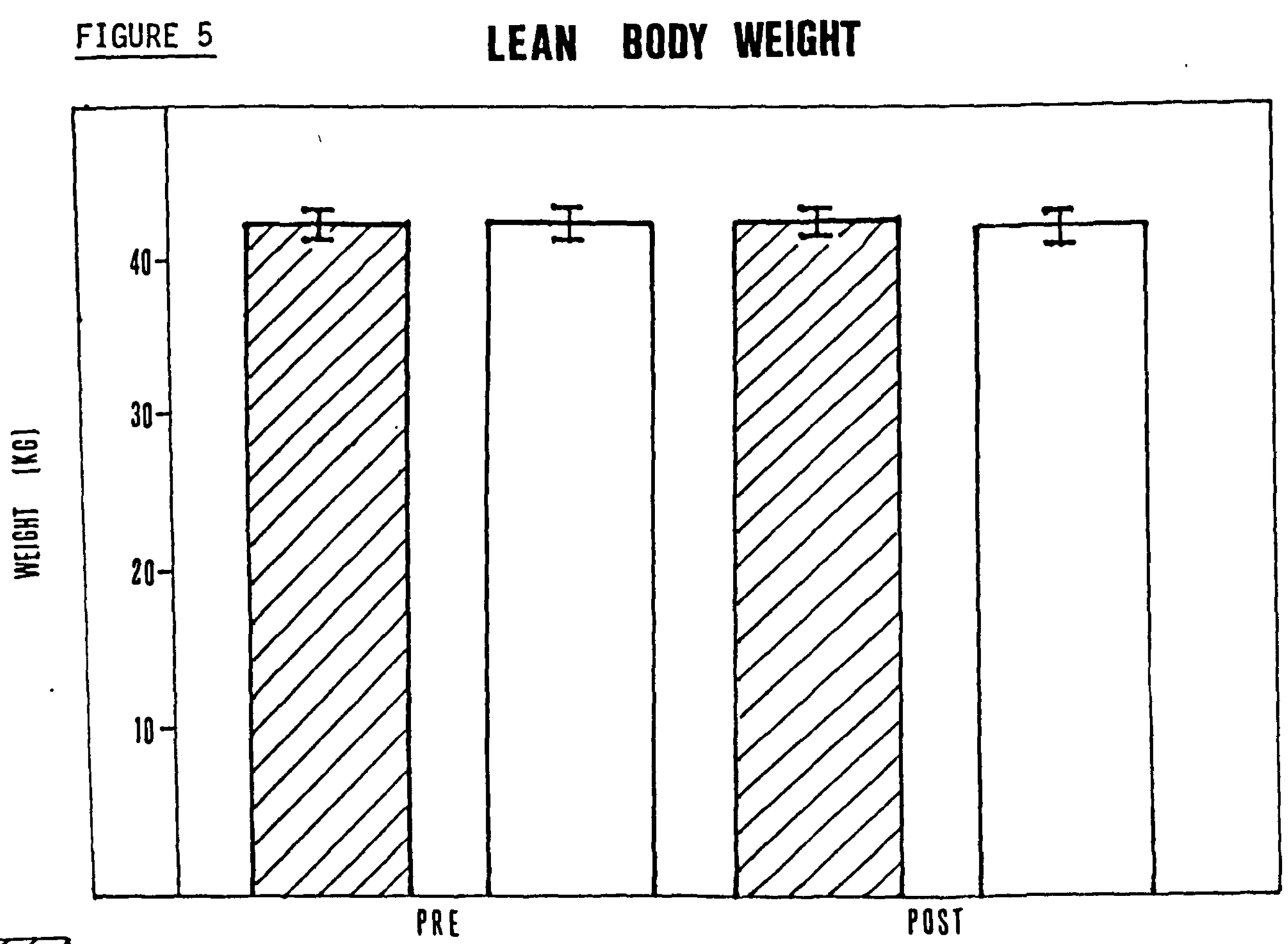
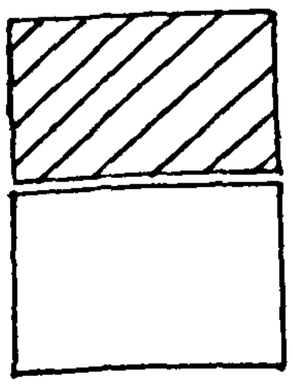


FIGURE 5





PRE/POST NON EX

PRE/POST EXERCISERS

FIGURES 4 & 5 - General Characteristics of the Non-Exercisers and Exercisers Pre- and Post-Conditioning Programme

FIGURE 6 HEATH-CARTER SOMATOTYPE ENDOMORPHY OF NON-EXERCISERS AND EXERCISERS PRE- AND POST - CONDITIONING PROGRAMME

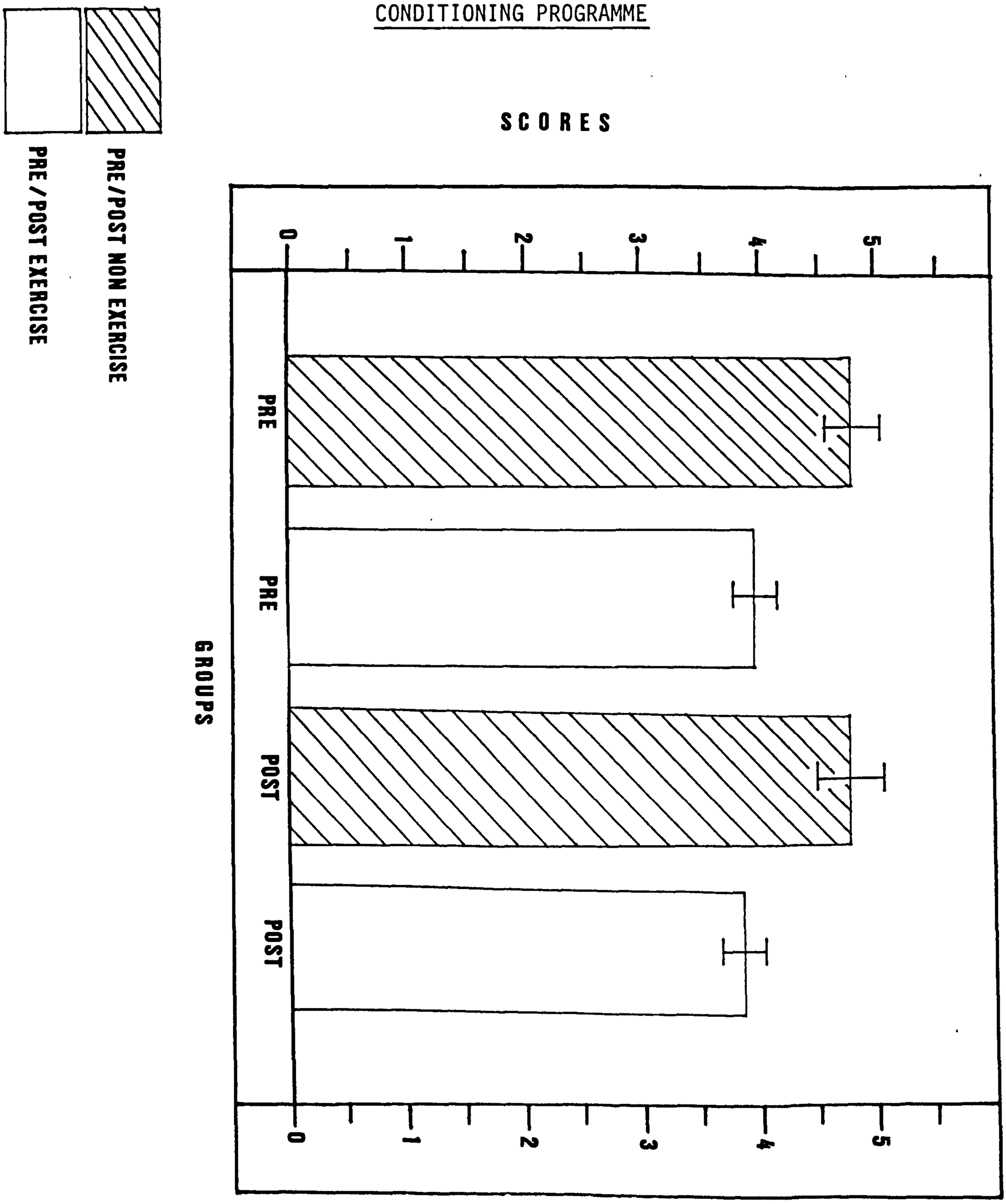


FIGURE 7

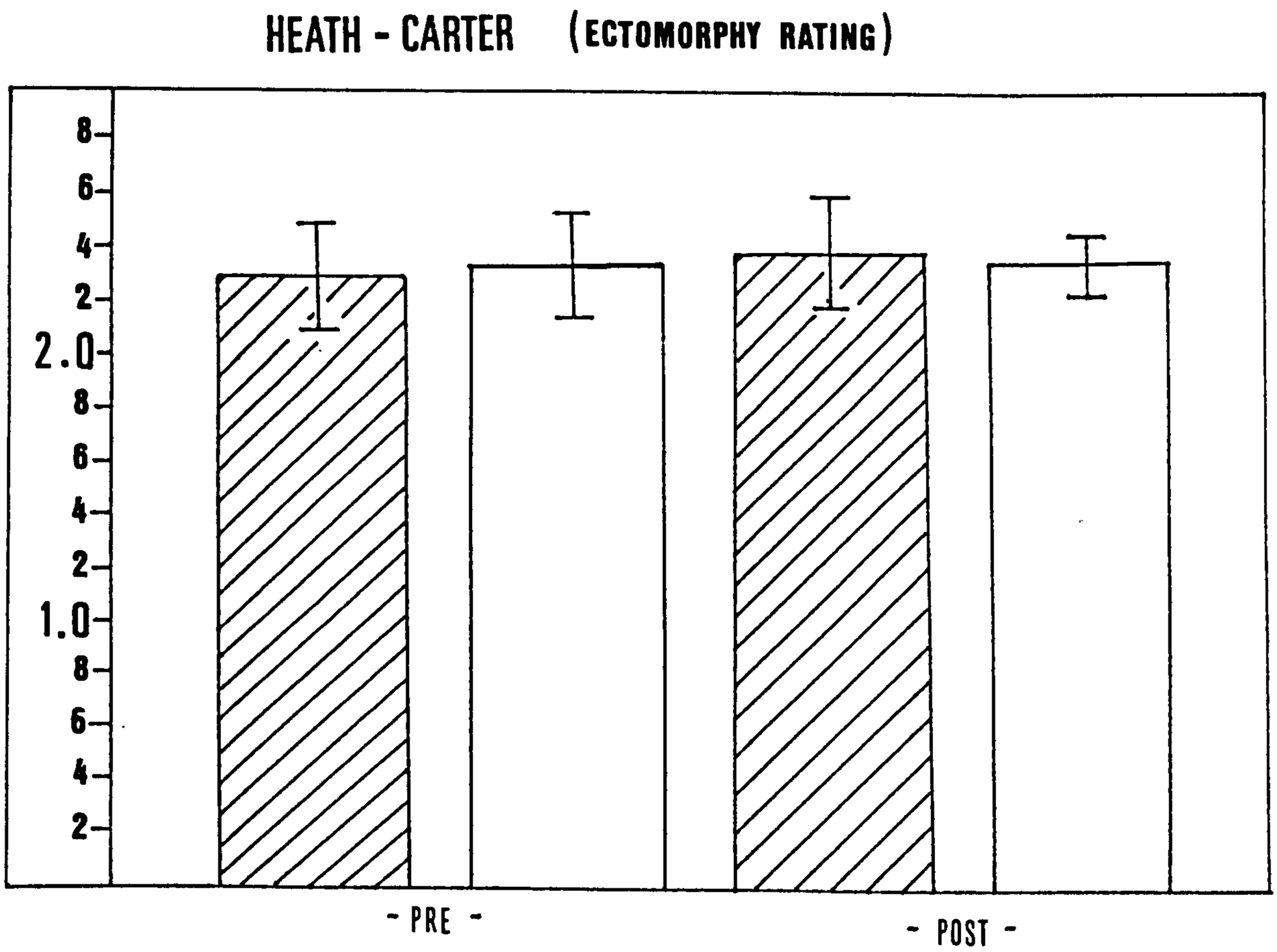
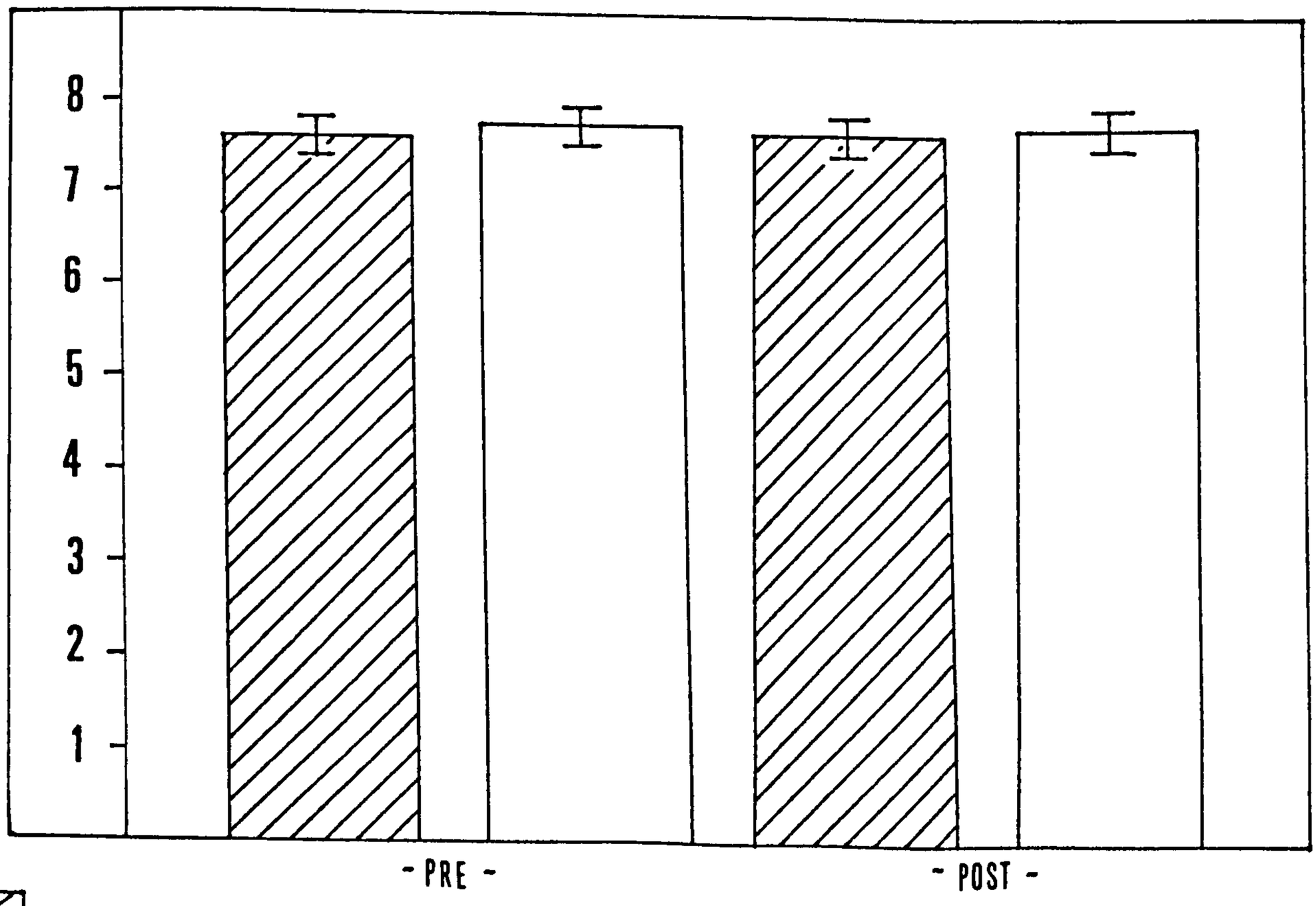
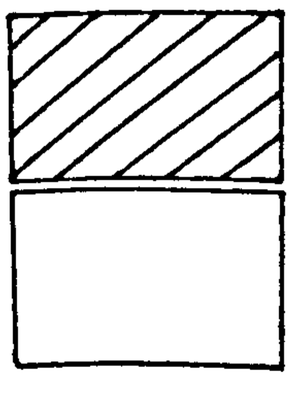
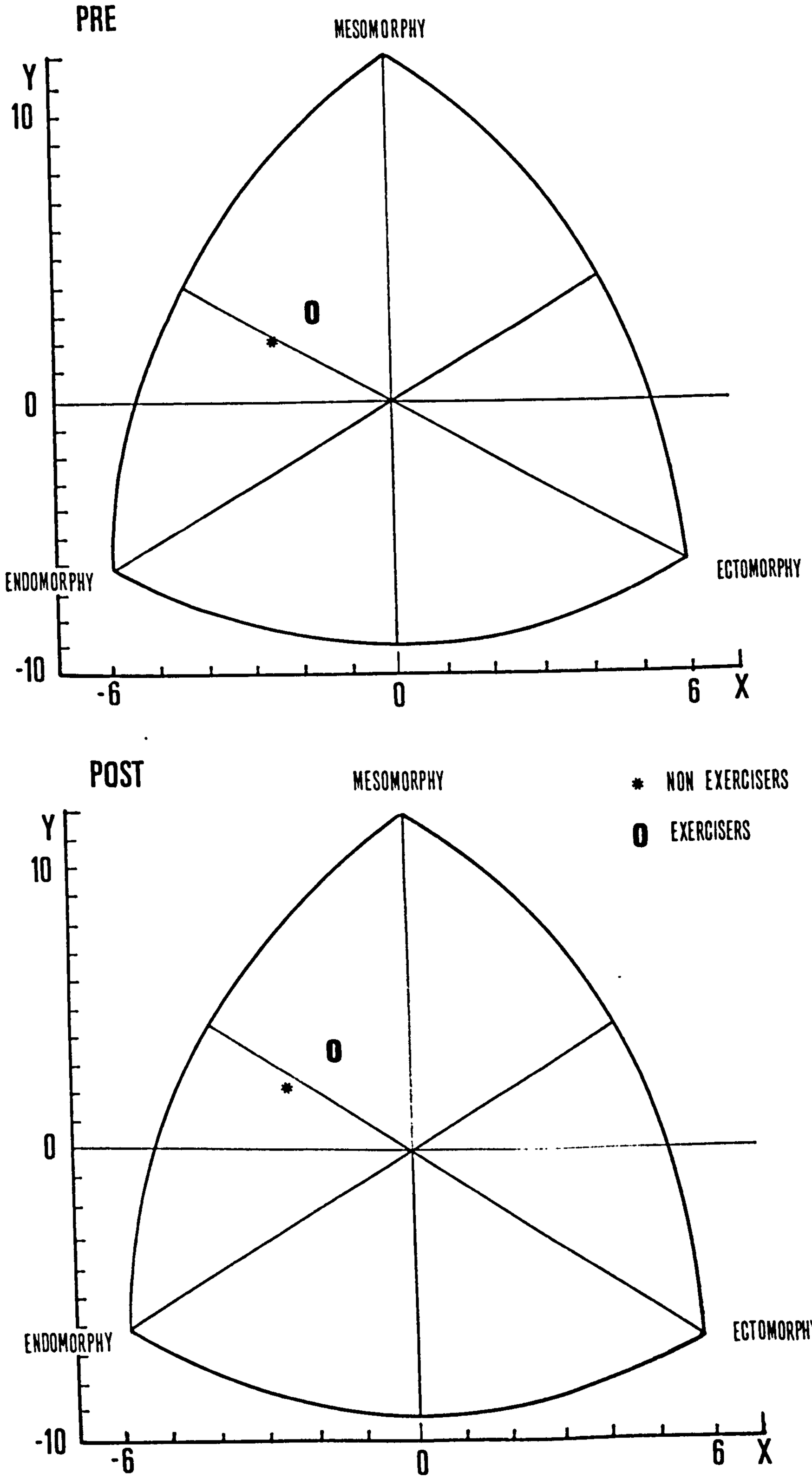


FIGURE 8





Figures 7 & 8 - Heath-Carter Somatotype Of Non-Exercisers and Exercisers Pre- and Post-Conditioning Programme



FIGURES 9 AND 10

Somatocharts (Heath-Carter) of the Non-Exercisers and Exercisers Pre- and Post-Conditioning Programme

FIGURE 11 - PHYSICAL FITNESS SCORES BASED ON THE ISMAIL ET AL CRITERION OF NON-EXERCISERS AND EXERCISERS PRE- AND POST- CONDITIONING PROGRAMME

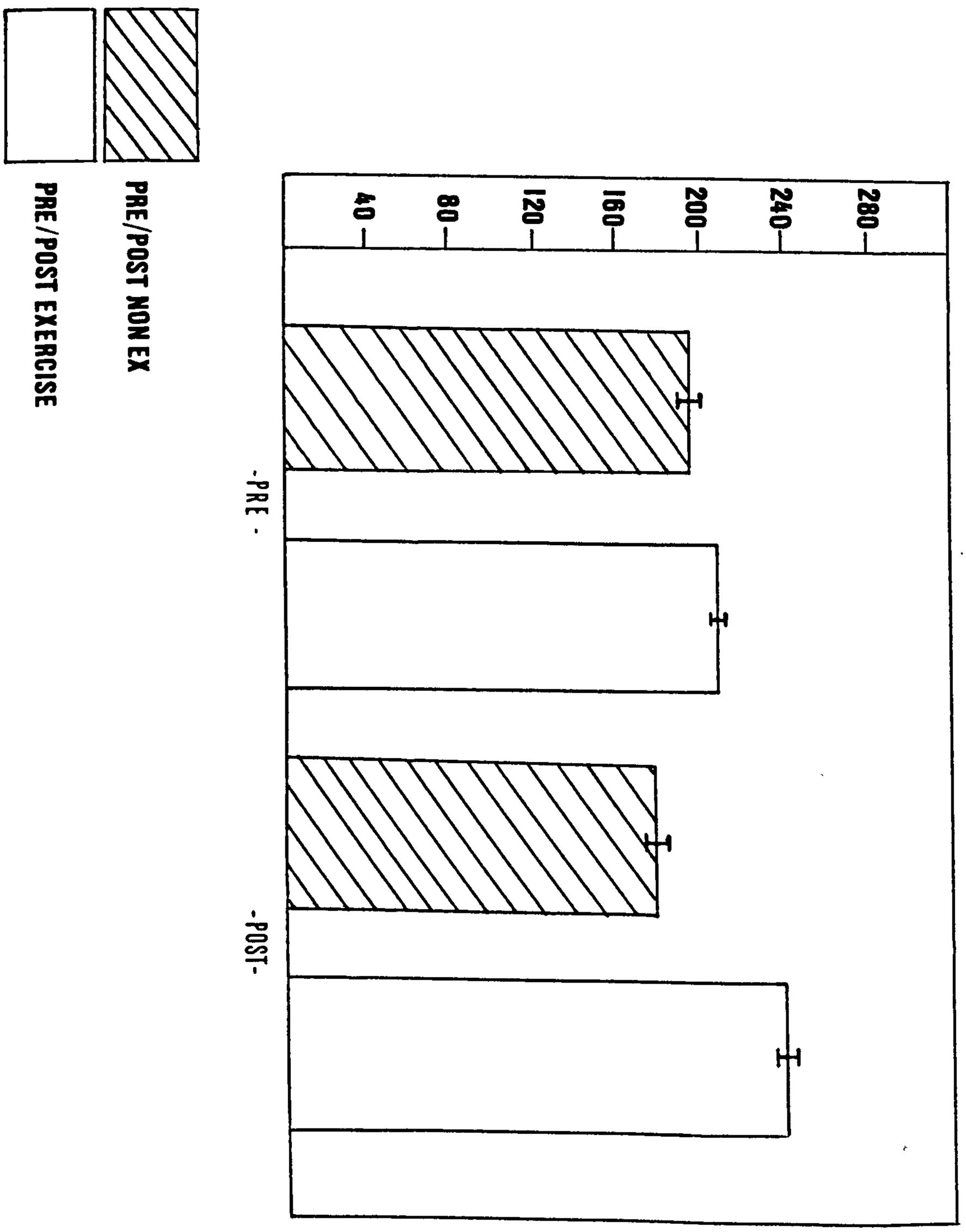


FIGURE 12 - EYSENCK PERSONALITY INVENTORY

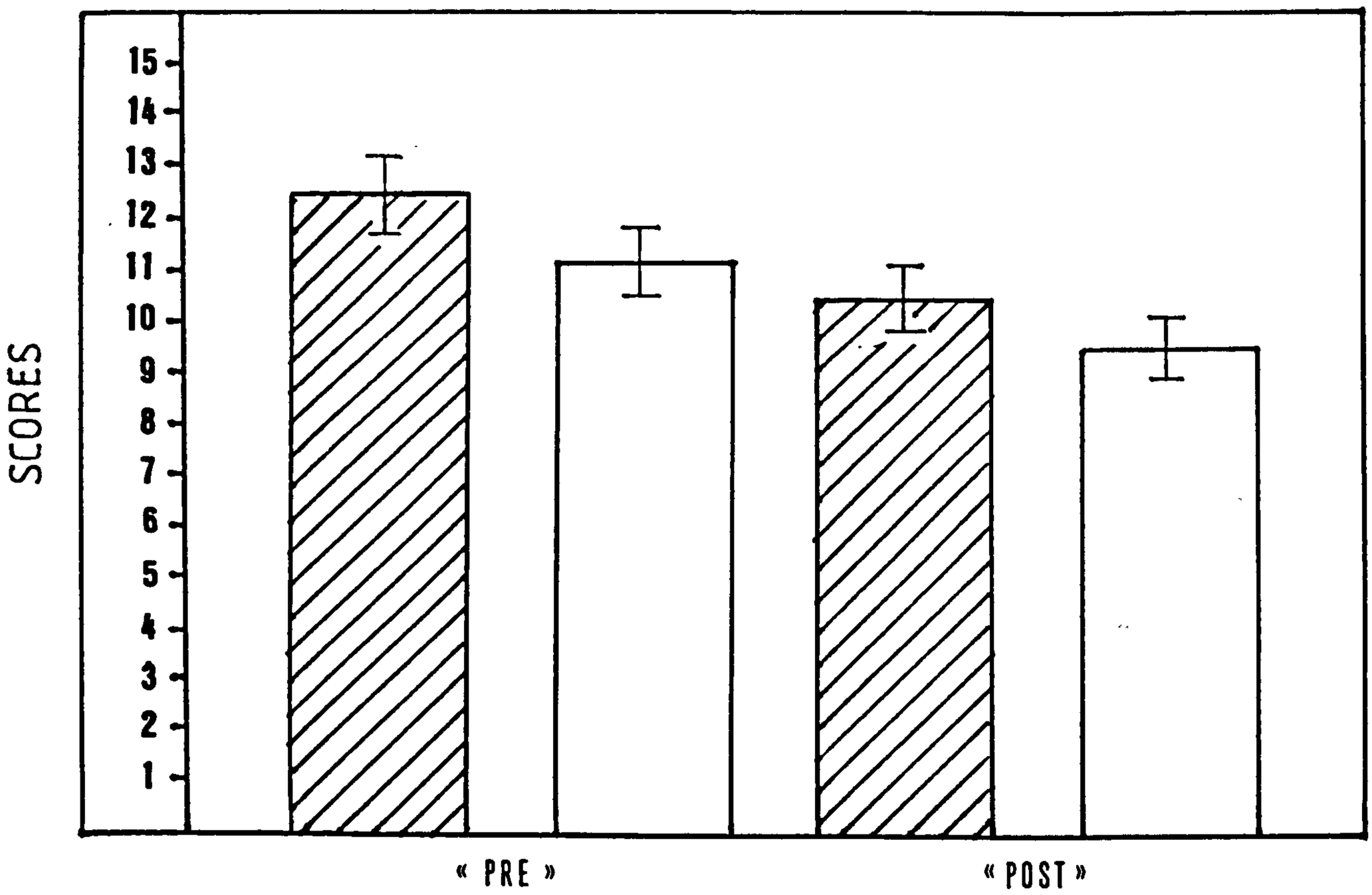
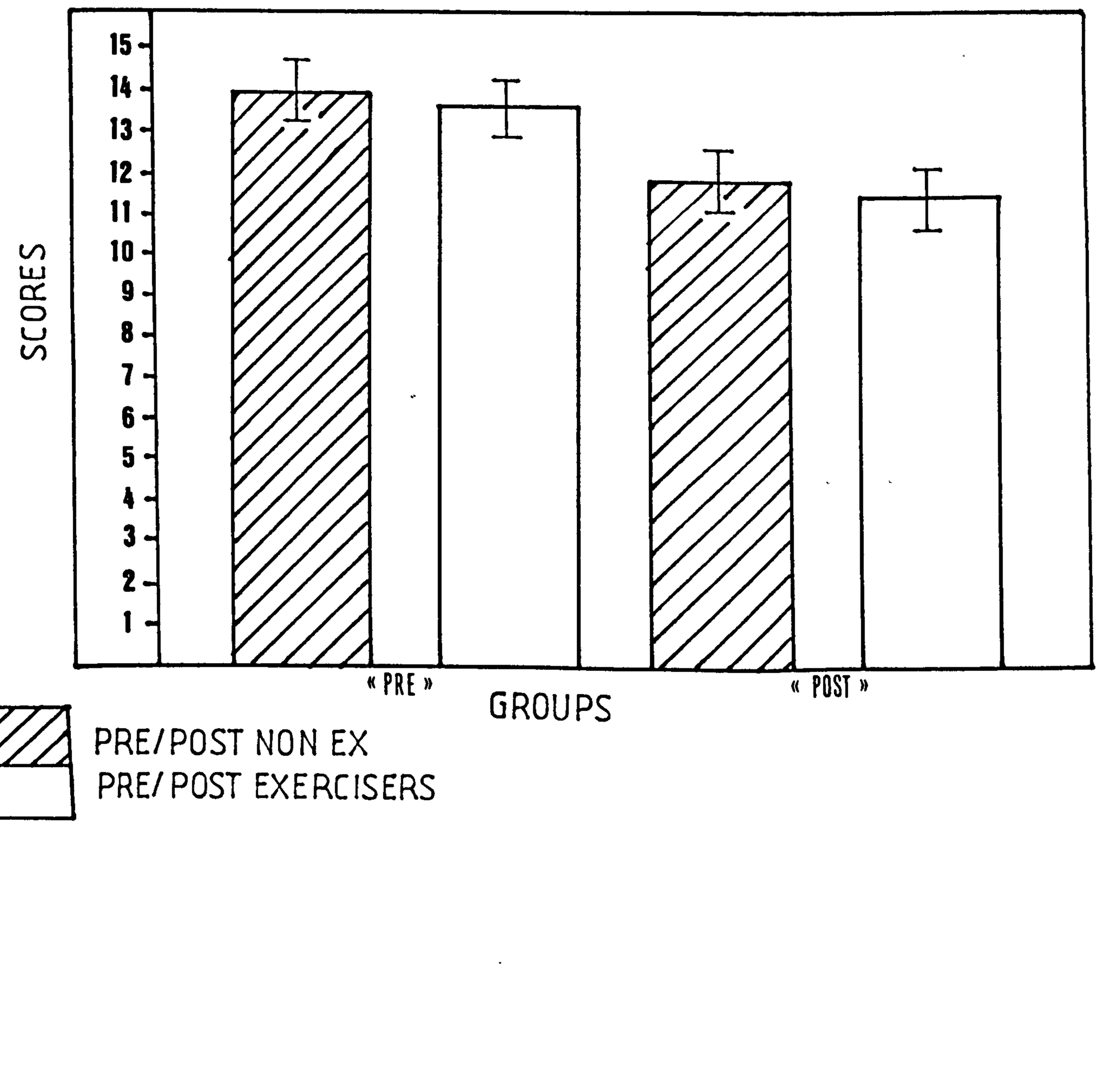


FIGURE 13



EYSENCK [L]

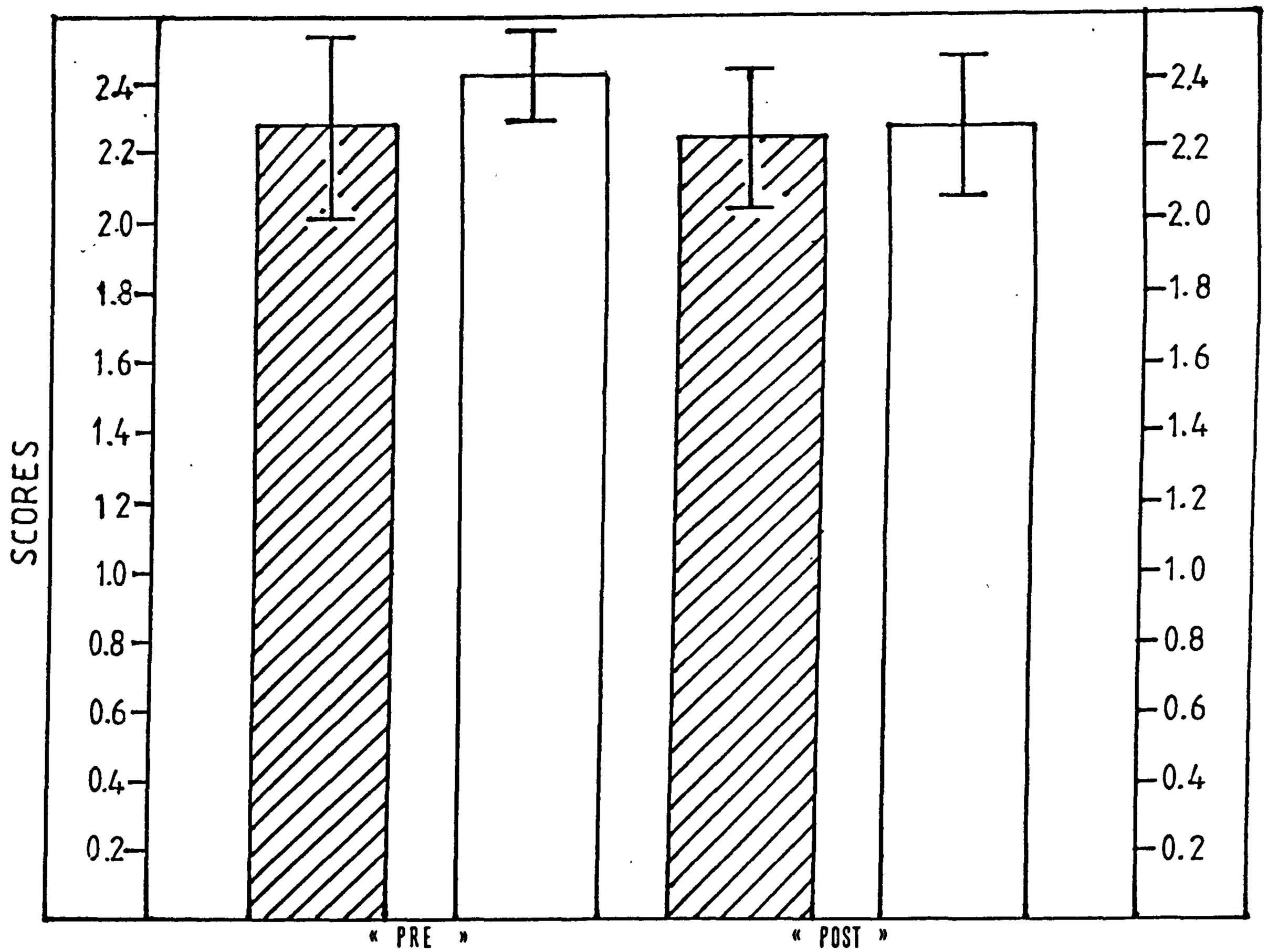
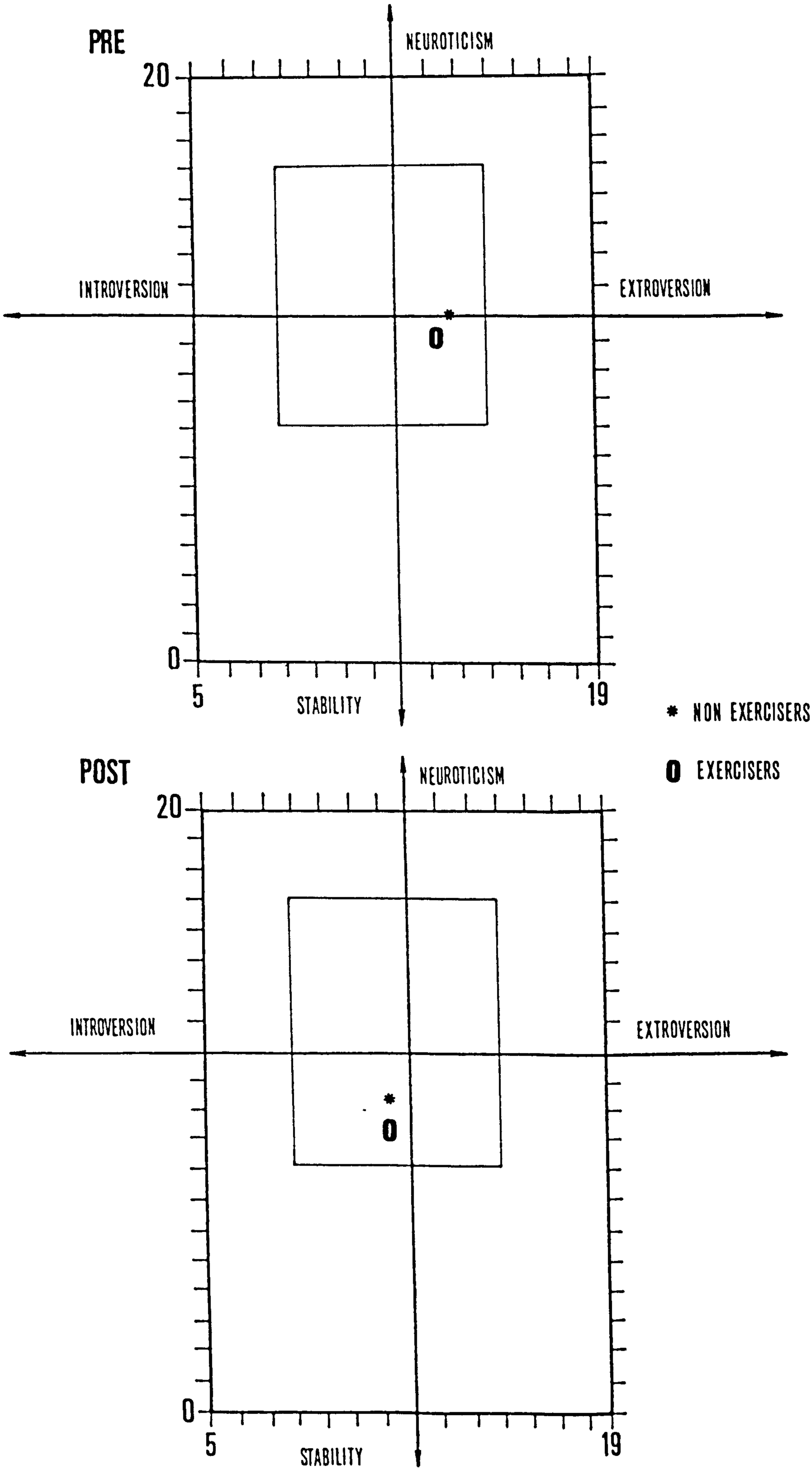


FIGURE 14



FIGURES 15 AND 16 - EYSENCK PERSONALITY INVENTORY PRE- AND POST-CONDITIONING PROGRAMME

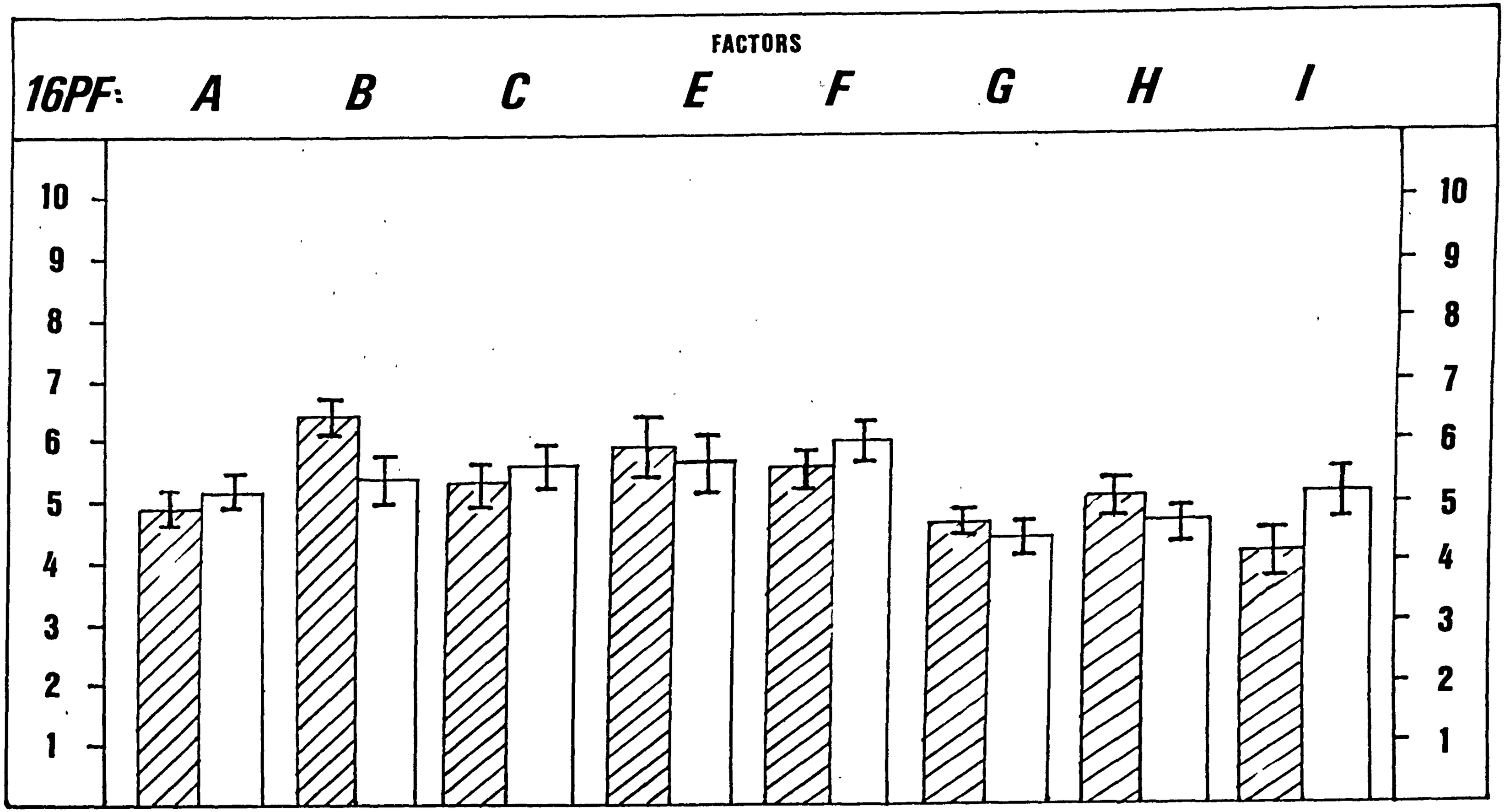


FIGURE 17 - CATTELL 16PF PRE CONDITIONING PROGRAMME

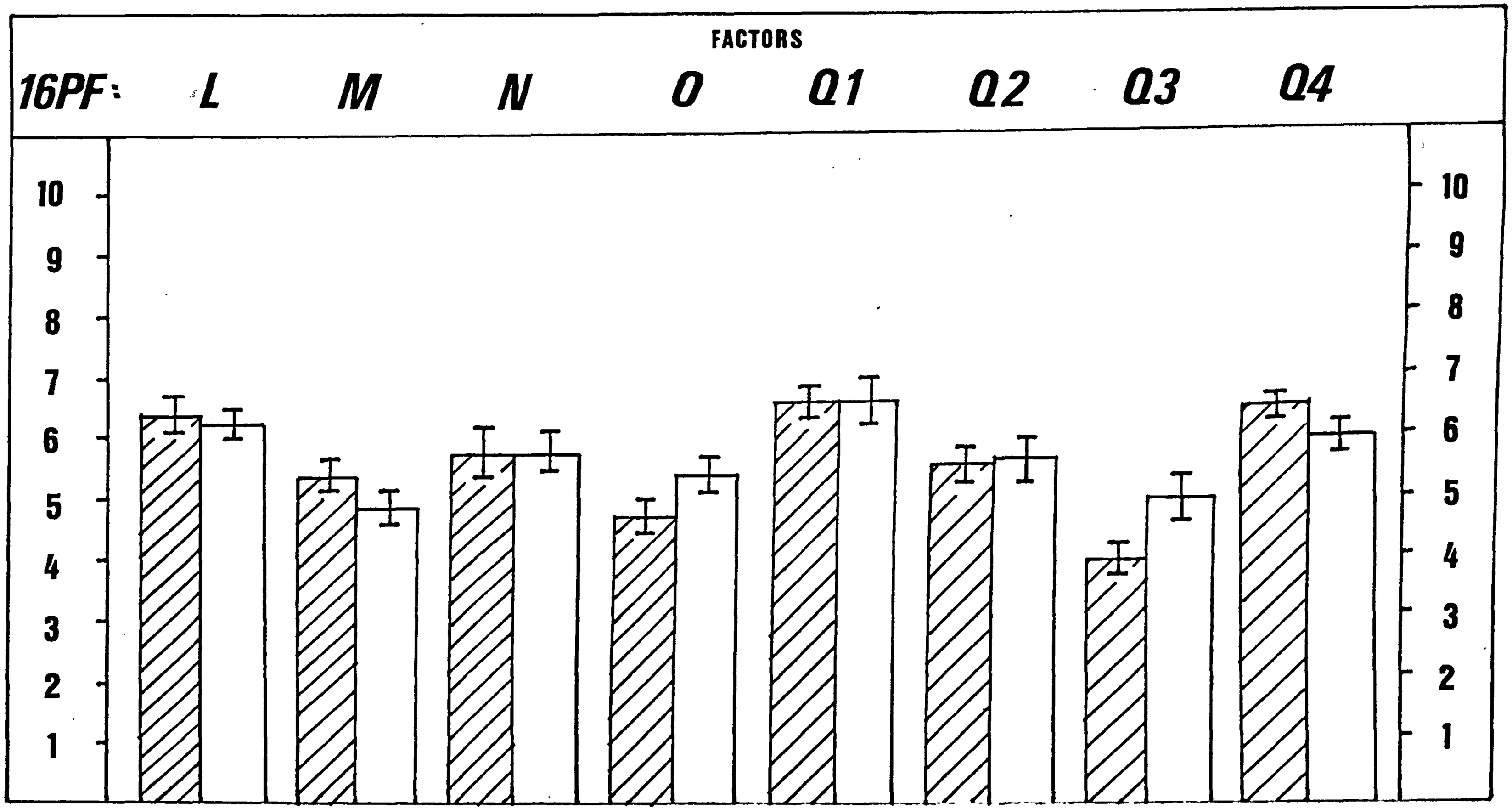


FIGURE 18 - CATTELL 16PF PRE-CONDITIONING PROGRAMME

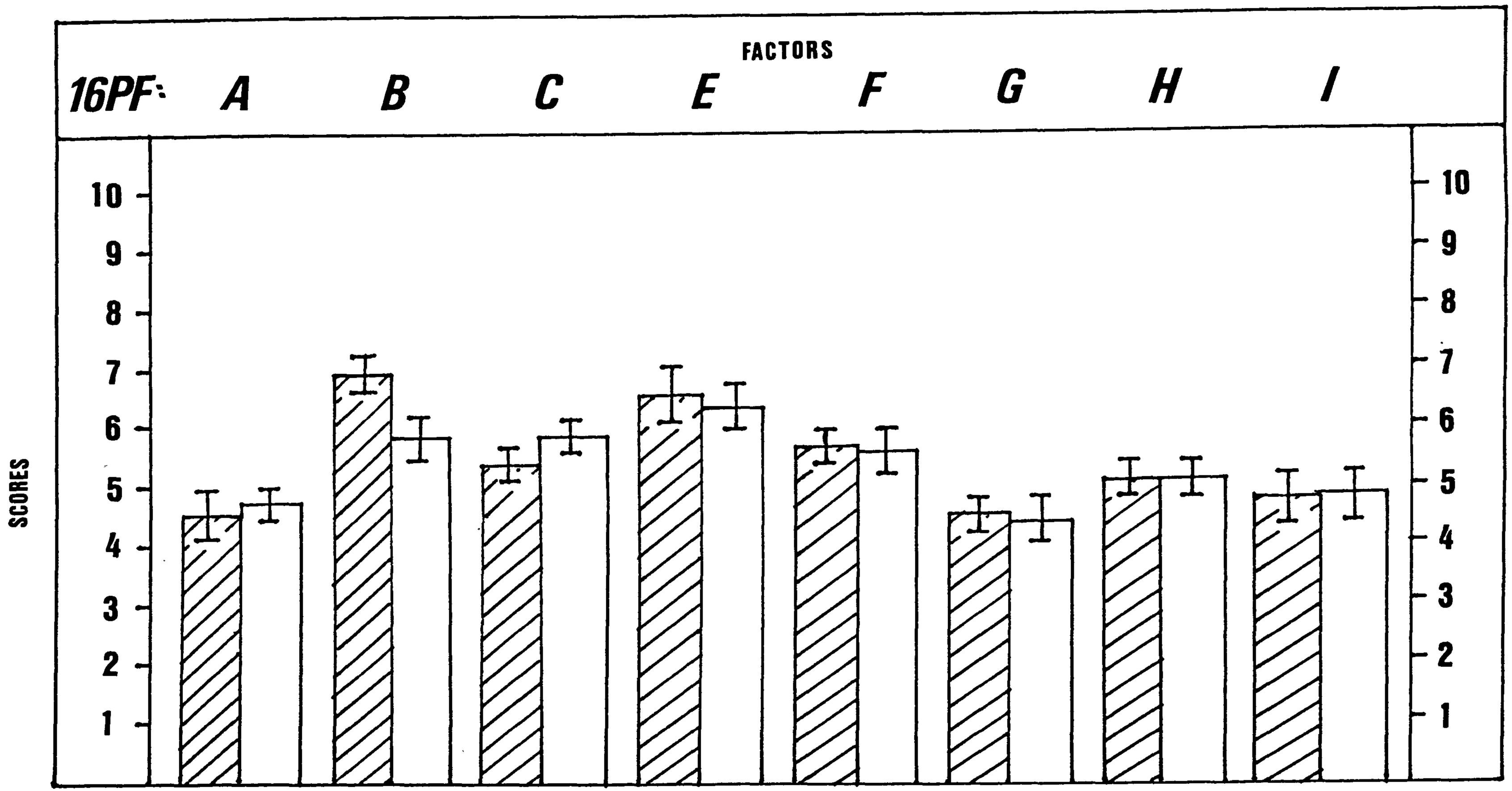


FIGURE 19 - CATTELL 16PF POST-CONDITIONING PROGRAMME

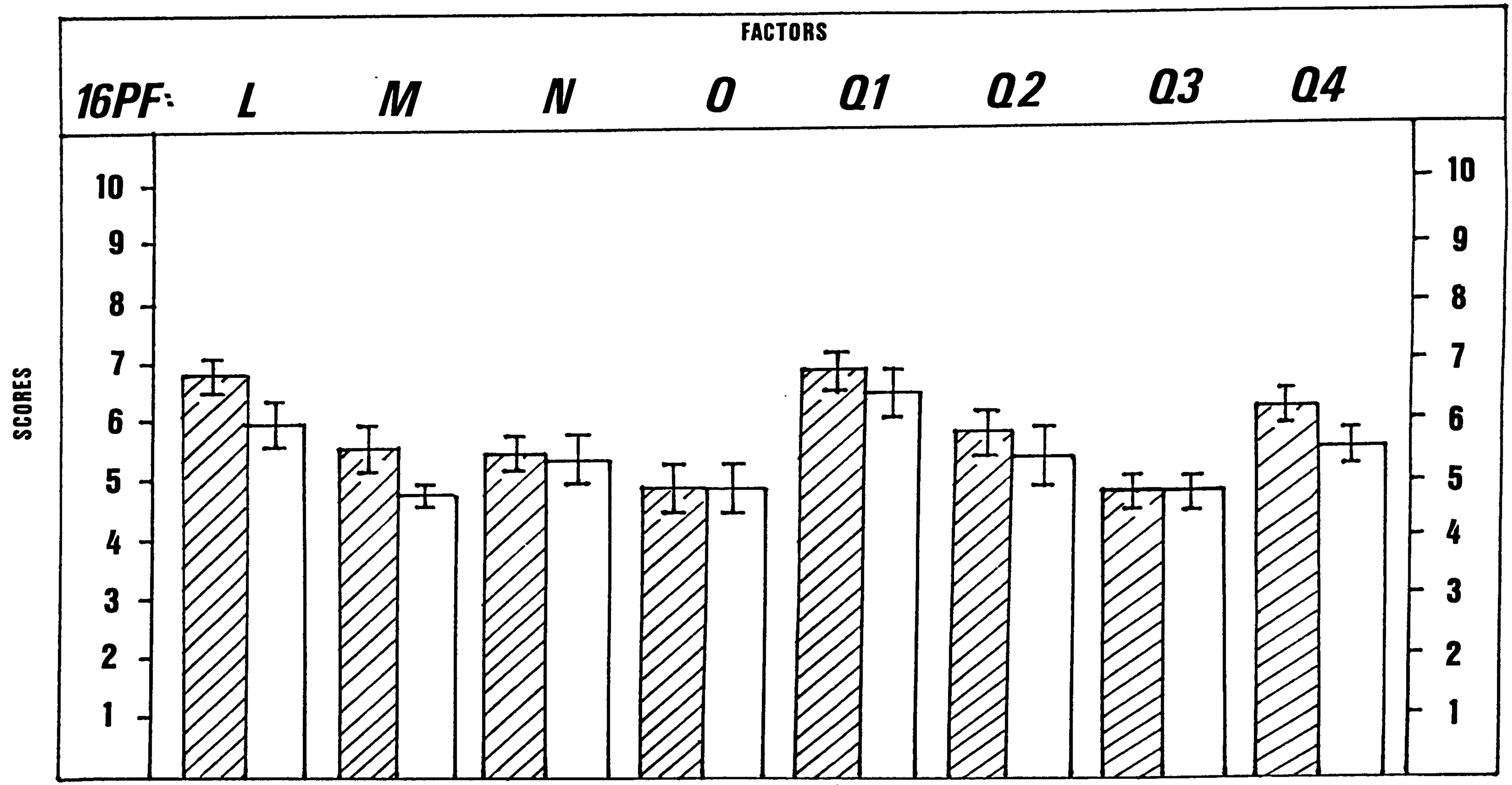


FIGURE 20 - CATTELL 16PF POST-CONDITIONING PROGRAMME

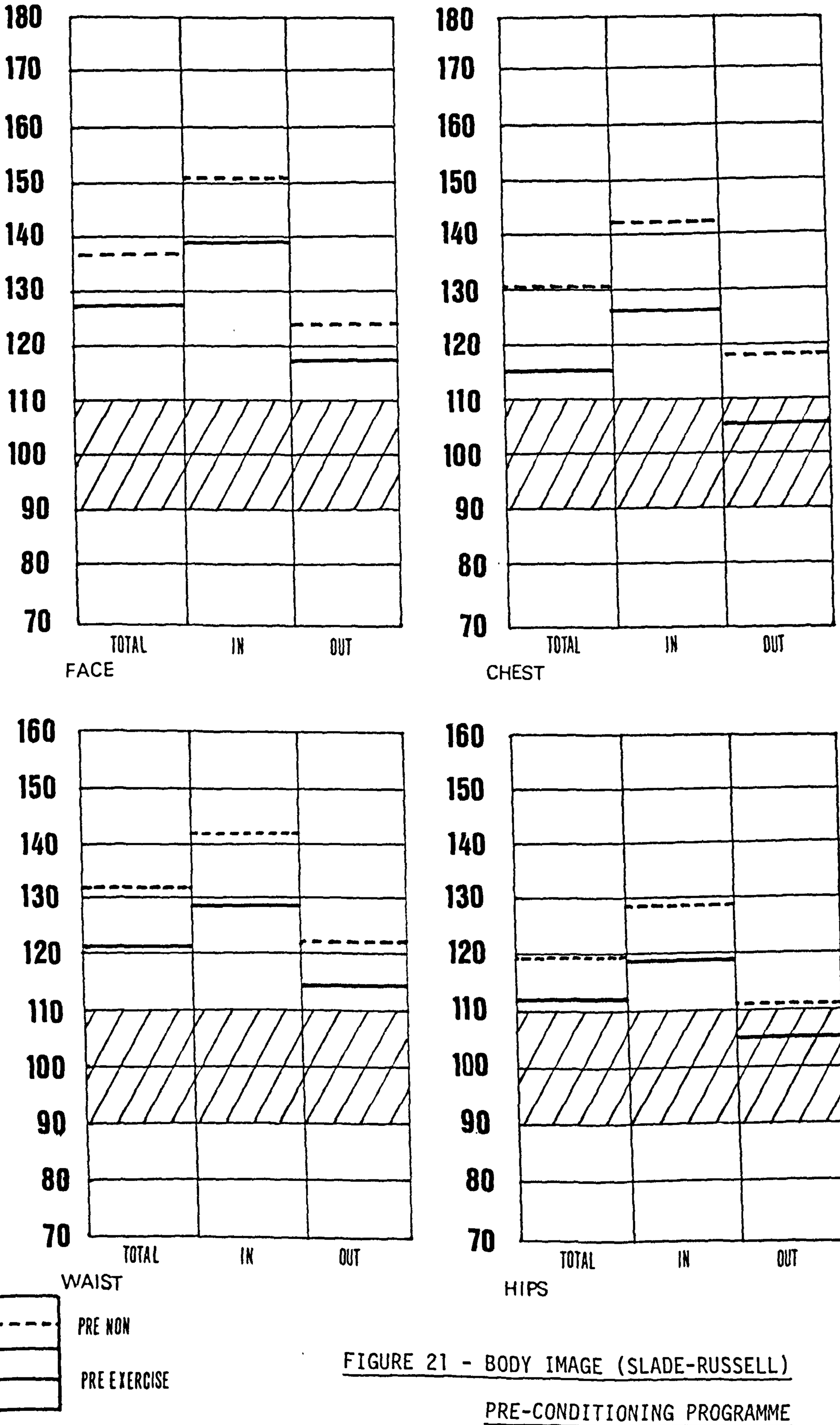
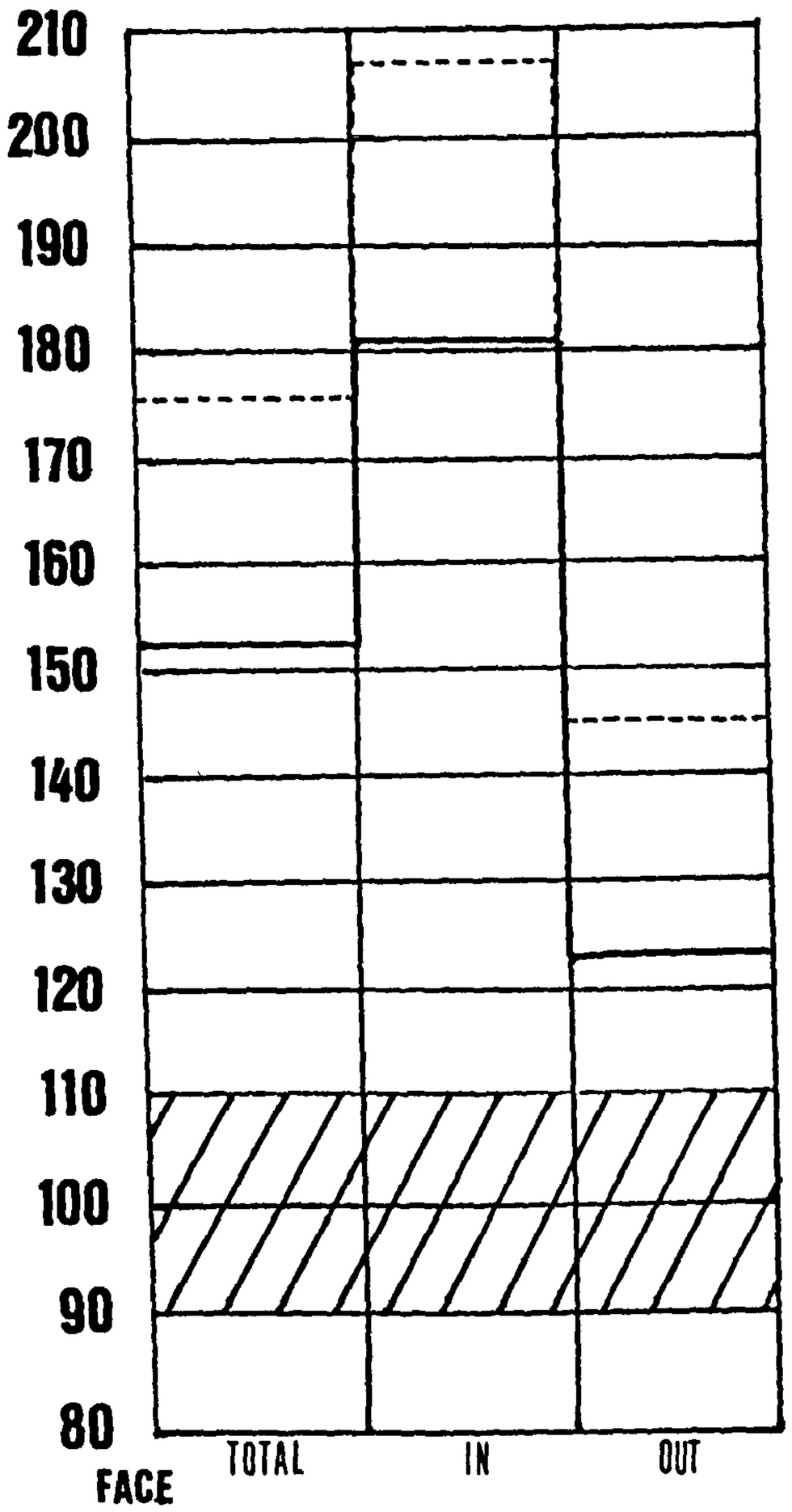
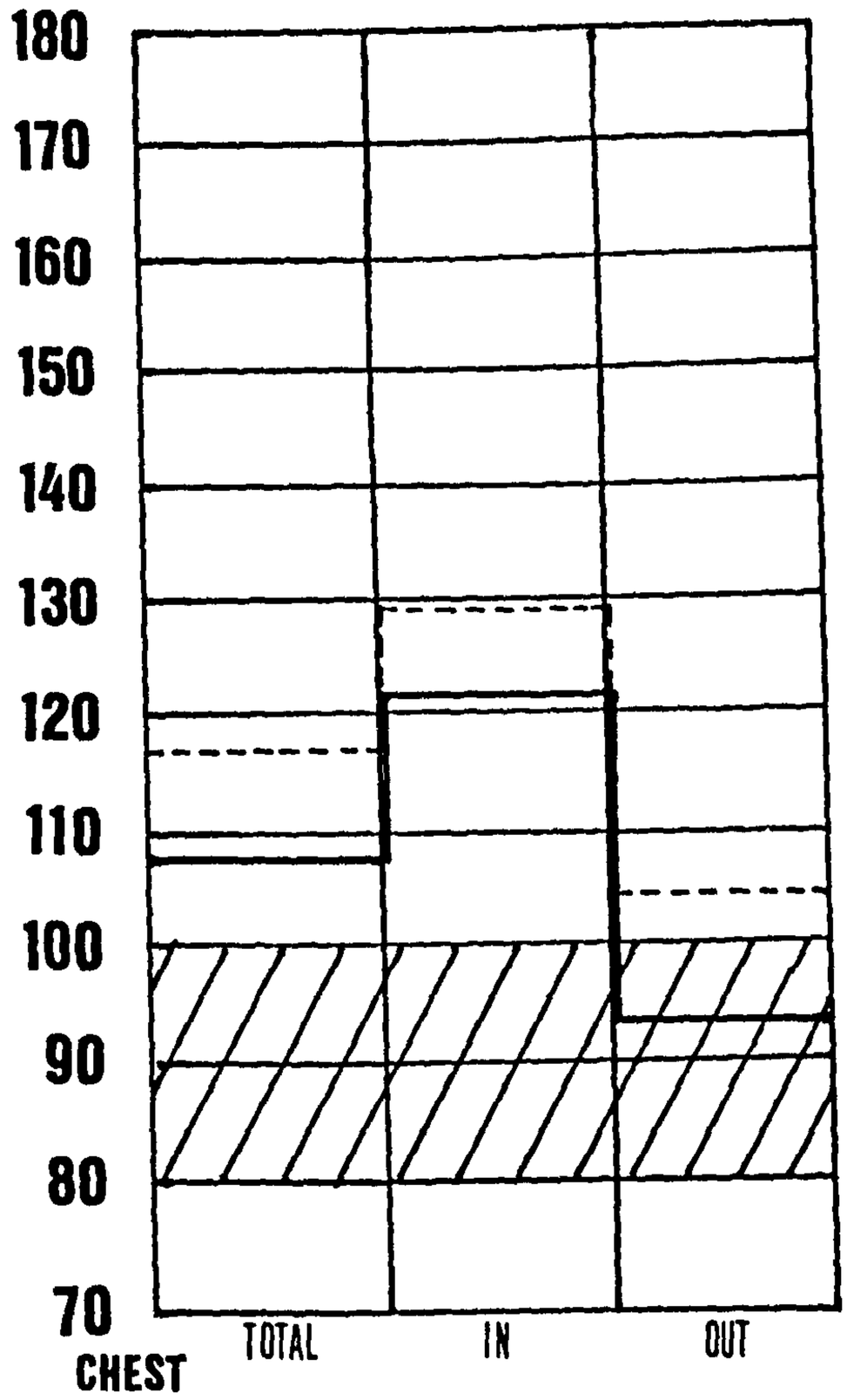
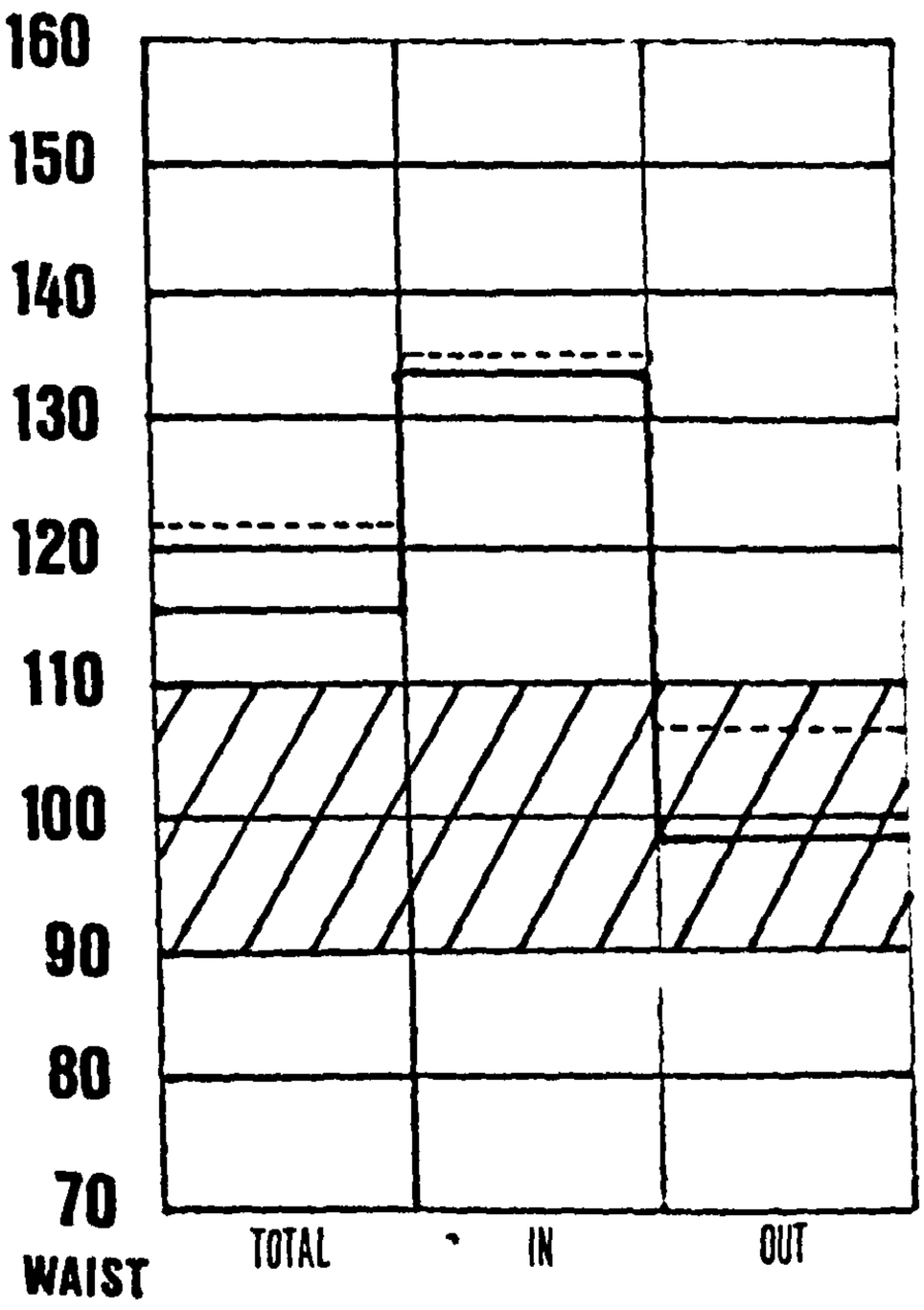


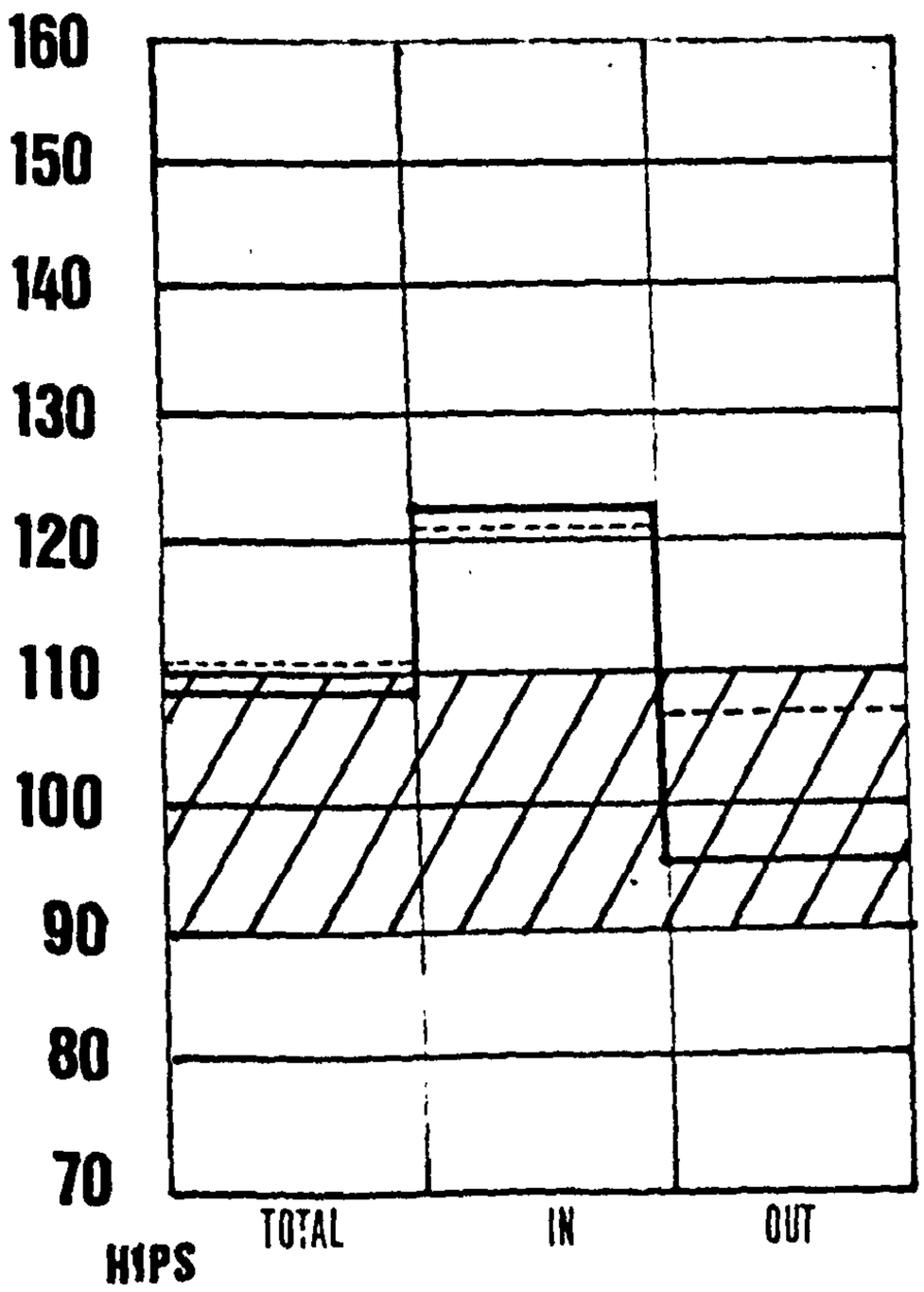
FIGURE 21 - BODY IMAGE (SLADE-RUSSELL)

PRE-CONDITIONING PROGRAMME









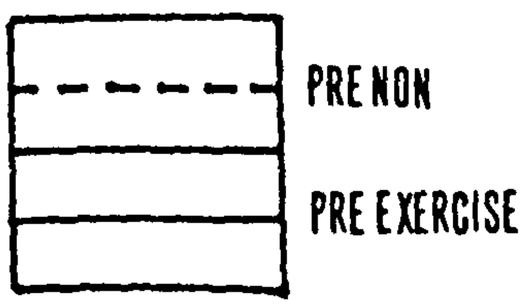


FIGURE 22 - BODY IMAGE (ABACUS)

PRE-CONDITIONING PROGRAMME

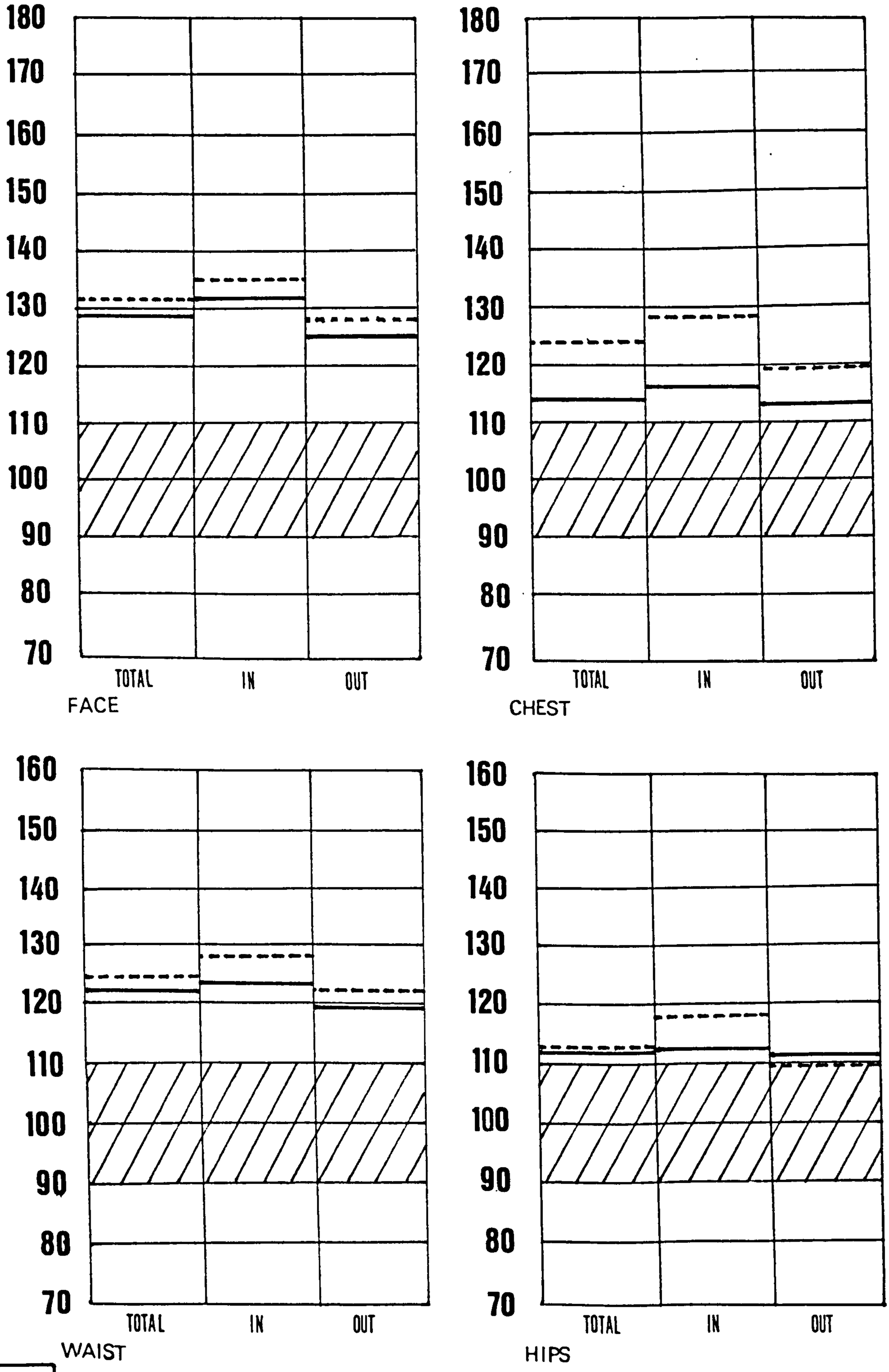


FIGURE 23 - BODY IMAGE (SLADE RUSSELL)

POST-CONDITIONING PROGRAMME

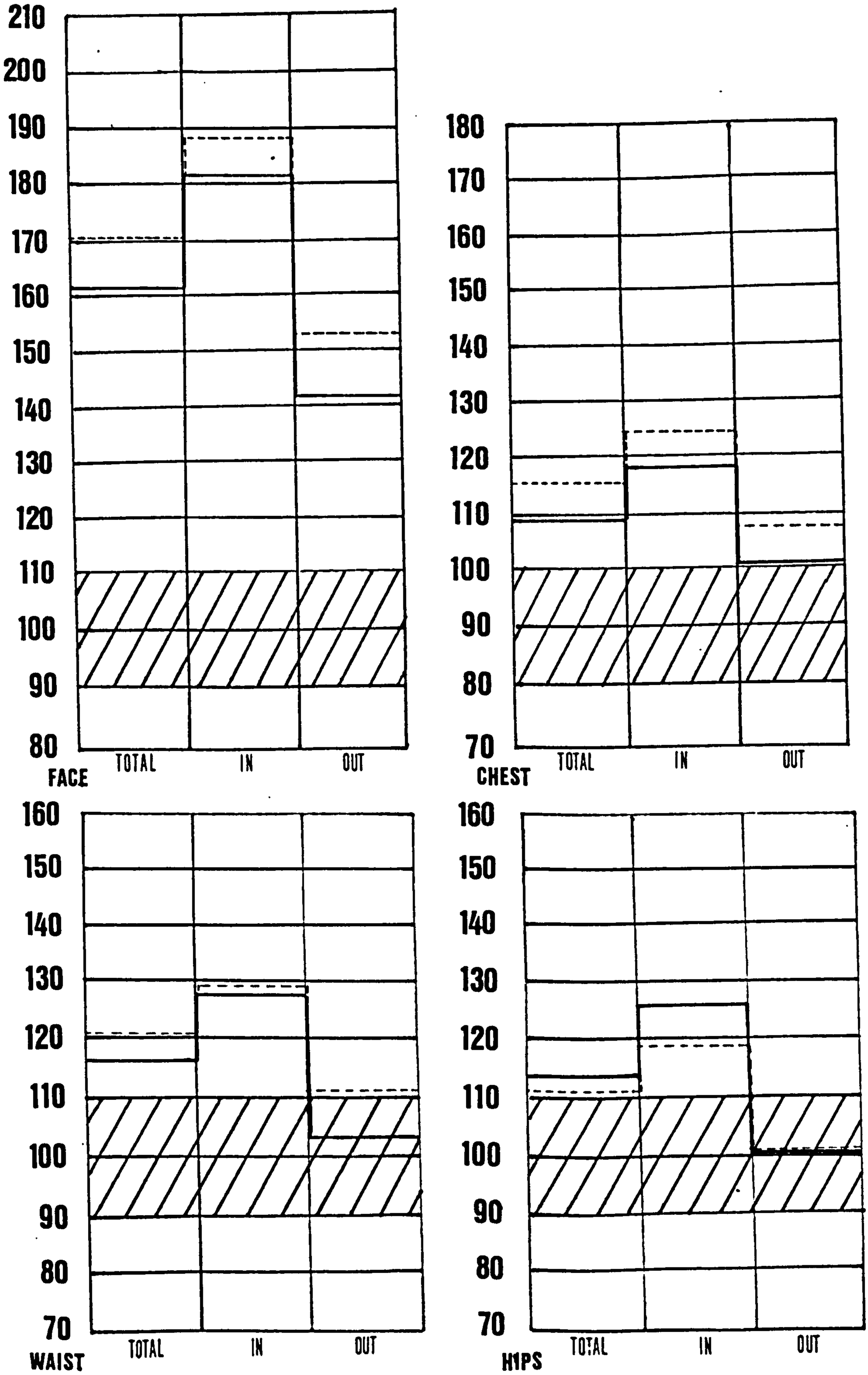


FIGURE 24 - BODY IMAGE (ABACUS)

POST CONDITIONING PROGRAMME

In Table 15 the Direction of Distortion means observed for the Face were similar for both groups. Again at the other three sites the non-exercising group had higher mean scores at the pre- and post-programme tests than the exercising group. There was a tendency for both groups to decrease their mean value at the post-programme test.

On the Range of Distortion means at the four sites, both groups were observed to have similar mean values.

4.6. Analysis of Correlation Matrices

The Pearson Product Moment Correlation Coefficient was used to determine the relationships among 34 anthropometric, personality and body image variables selected from the original 56 variables at pre- and post-programme tests. An attempt was made to present the most meaningful relationships among the variables of interest. Therefore selected coefficients are discussed in order to illustrate such relationships.

4.6.1. Correlation Matrix for the Pre-Programme Data on Anthropometric, Personality and Body Image Variables - Both Groups

Table 16 contains the inter-corrrelations of the 34 selected variables for both groups of 50 subjects for the pre-programme data. The correlation coefficients ranged from -0.74 to 0.96. With 48 degrees of freedom a correlation of 0.273 is required for significance at the 0.05 level.

Among the anthropometric variables measured, weight correlated 0.61 with estimated percentage body fat and 0.96 with the endomorphy component of the Heath-Carter somatotype. The Ismail Fitness Score correlated -0.27 with weight, -0.59 with percentage

body fat, with the EPI extraversion factor -0.24 and the psychotism factor 0.34, with the 16PF Factor A (aloof and cold vs. warm and sociable) and with Factor Q_1 (conservative and accepting vs. experimenting and critical) 0.28.

Among the personality variables measured, the EPI neuroticism factor correlated -0.34 with Factor C (emotionally unstable vs. mature and calm), with Factor L (trustful and adaptable vs. suspecting and jealous), and with Factor Q_3 (lax and unsure vs. controlled and exact). The EPI extraversion factor correlated 0.29 with Factor A, with Factor E (submissive and mild vs. dominant and aggressive) 0.27 and with Factor F (glum and silent vs. enthusiastic and talkative) 0.56.

Amongst the Body Image variables, those measured by the SEA, the Chest Total correlated 0.26 with Factor I (tough and realistic vs. sensitive and effeminate), with Face Total 0.51 and with the Waist Total 0.63. The Hips Total correlatd 0.21 with Factor Q_4 (phlegmatic and composed vs. tense and excitable) with Chest Total 0.52 and with Waist Total 0.58. This shows that there is a degree of inter-correlation amongst these 34 selected variables.

Table 17 contains the inter-correlations of the 34 selected variables for both groups of 50 subjects for the post-programme data. The correlation coefficients ranged from -0.66 to 0.96.

Among the anthropomorphic variables similar inter-relationships were observed as commented on in the pre-programme correlation matrix. All the anthropometric, personality and body image variables showed similar inter-relationships and correlation coefficients. (Separate matrices were calculated for pre- and post-groups because pre- and post-measurements are not independent.

Table 18 shows the correlations of the direction of distortion, magnitude of distortion and range scores as measured by the SEA pre-programme. The correlation coefficients ranged from 0.17 to 0.93. Among the direction of distortion scores all four sites were significantly correlated at the $p<0.05$ level of significance. A similar level of significance can be observed for the magnitude of distortion scores and the range scores. The inter-correlations of the three scores of direction, magnitude and range show an inter-relationship which can be seen to be significant.

Table 19 contains the inter-correlations of the direction of distortion, magnitude of distortion and range scores for the body image as measured by the Abacus programme. The correlation coefficients range from 0.251 to 0.77. The same trends as observed in the SEA table are observed; all correlation coefficients are significant at the $p<0.05$ level.

In Tables 20-21 show the post-programme body image data as measured by the SEA and Abacus respectively are shown. Virtually all correlation coefficients are significant at the $p<0.05$ level.

This high degree of inter-correlation amongst the variables should be borne in mind when interpreting results of univariate analysis of variance.

4.7. Repeated Measures Analysis of Variance

When the same variable is measured on several occasions for each subject, a repeated measures design should be used. The simplest repeated measures design is one in which two measurements are obtained for each subject (e.g. pre- and post-programme test scores). The data is then analysed with a paired t-test. The advantages of using the repeated measures design are firstly that

TABLE 16 CORRELATION MATRIX OF 34 ANTHROPOMETRIC PERSONALITY BODY IMAGE VARIABLES (SELECTED FROM THE ORIGINAL 56 VARIABLES) PRE-PROGRAMME TEST

(Correlation coefficients greater than 0.273 are significant at the 5% level)

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
ANTHROPOMETRIC																																		
Weight	1.0																																	
Lean Body Weight	.81	1.0																																
% Body Fat	.61	.10	1.0																															
Endomorphy	.66	.18	.96	1.0																														
Mesomorphy	.23	.05	.50	.47	1.0																													
Ectomorphy	-.45	-.07	-.71	-.69	-.74	1.0																												
Ismail Fitness Score	-.27	.05	-.59	-.57	-.44	.42	1.0																											
PERSONALITY																																		
EPI - N	.18	.15	.08	.07	.22	-.14	-.13	1.0																										
- E	.27	.21	.22	.26	.15	-.22	-.24	-.12	1.0																									
- L	-.15	.00	-.27	-.30	-.28	.41	.34	-.22	-.08	1.0																								
16PF - A	-.02	-.17	.20	.20	.16	-.23	-.25	-.21	.29	-.26	1.0																							
- B	-.10	-.12	.03	-.03	-.02	-.09	.10	.01	-.06	-.00	.02	1.0																						
- C	.17	.16	.05	.07	-.04	.01	.17	-.34	.18	.04	.12	-.22	1.0																					
- E	.05	.08	.09	.13	.16	-.13	,01	-.13	.27	-.19	.26	.25	.11	1.0																				
- F	.25	.22	.16	.14	.19	-.17	-.13	-.02	.56	-.00	.22	-.00	.27	.15	1.0																			
- G	.3	-.00	.12	.10	.01	.00	.00	.04	-.29	.16	-.26	-.22	.01	-.31	-.23	1.0																		
- H	-.05	.16	.20	.22	.13	-.18	-.13	-.03	.55	-.07	.45	.10	.24	.36	.32	-.43	1.0																	
- I	-.16	-.15	-.01	-.06	-.07	.23	.00	-.23	-.05	.10	.20	-.03	.03	.02	-.08	-.22	.17	1.0																
- L	-.00	-.06	-.02	.00	.18	-.10	.03	.26	-.22	-.18	-.16	.02	-.37	-.09	.02	-.10	-.10	-.09	1.0															
- M	-.11	-.05	-.10	-.13	-.30	.30	.03	-.02	-.11	.05	-.10	.08	.15	-.02	-.35	.10	.00	.01	-.36	1.0														
- N	.01	-.03	.01	-.04	.34	-.06	-.08	.13	-.03	-.09	-.12	.11	-.25	-.35	-.13	.10	-.20	-.13	-.10	.04	1.0													
- O	.03	-.06	.14	.15	.29	-.24	-.17	.34	.06	-.21	.01	-.13	-.00	-.12	.03	.15	-.02	-.02	.15	-.02	.25	1.0												
- Q_1	-.01	.19	-.23	.26	-.04	.13	.28	-.07	.11	.09	.03	.12	.17	.14	.07	-.15	.22	-.06	.05	.15	-.24	-.19	1.0											
- Q_2	-.10	-.05	-.04	.02	-.08	.14	.00	.19	-.38	.17	-.25	-.02	-.24	.09	-.40	.13	-.18	-.24	.00	.27	-.15	-.03	.01	1.0									
- Q_3	-.14	-.18	-.03	-.02	-.18	.08	.12	-.32	-.35	.18	-.13	-.08	-.07	-.32	-.24	.20	-.08	.16	.00	.13	-.11	-.26	-.21	.11	1.0								
- Q_4	.20	.17	.18	.17	-.07	-.06	-.16	.17	-.08	-.18	-.09	.13	-.16	-.17	-.03	.07	-.31	.10	-.02	.00	.12	.32	-.13	.02	-.00	1.0								
BODY IMAGE																																		
SLADE RUSSELL																																		
Face (Total)	-.13	-.02	-.13	-.08	-.24	.17	.20	-.16	.02	.13	.10	-.05	.13	.10	-.04	.01	.03	-.04	-.07	-.17	-.13	.04	.12	-.03	-.26	.07	1.0							
Chest (Total)	.14	.08	.16	.22	.03	-.00	.03	-.08	-.06	-.03	-.15	.04	.15	.24	-.04	.29	-.15	-.26	-.02	-.16	-.06	.08	.00	.15	-.13	.17	.51	1.0						
Waist (Total)	.20	.05	.21	.24	.11	-.11	-.13	.03	.04	-.05	-.15	.02	.12	.15	-.09	.20	-.00	.06	-.00	-.16	.10	.23	-.00	-.01	-.22	.11	.30	.63	1.0					
Hips (Total)	.37	.29	.20	.22	.13	-.21	-.01	-.04	.10	-.07	-.15	-.05	.17	.09	.17	.37	.00	-.13	.03	-.24	.02	.17	.17	-.14	-.03	.21	.23	.52	.58	1.0				
ABACUS																																		
Face (Total)	.19	.17	.08	.15	-.08	.04	.02	.18	-.00	.12	-.06	.05	.01	.08	.01	.02	.08	-.21	.08	-.00	-.07	.05	.10	.22	-.22	.05	.49	.37	.26	.28	1.0			
Chest (Total)	.16	.12	.13	.20	.08	.06	.03	.10	-.05	.02	-.22	.07	-.06	.16	-.08	.11	-.03	-.03	.28	-.08	-.10	-.05	-.03	.17	-.13	.06	.20	.49	.40	.24	.55	1.0		
Waist (Total)	.25	.18	.16	.18	.20	-.07	-.05	.20	.06	.06	-.13	-.00	-.11	.17	.00	-.11	-.54	-.05	.17	-.12	.09	-.00	-.00	.13	-.09	-.07	-.06	.22	.49	.20	.37	.58	1.0	
Hips (Total)	.20	.13	.16	.16	.23	-.03	-.09	.09	.05	.08	.06	.04	-.09	.20	.10	.02	-.05	.10	.20	-.28	-.07	.03	-.03	.15	-.17	.03	.14	.25	.31	.25	.34	.51	.64	1.00

TABLE 17 CORRELATION MATIRX OF 34 ANTHROPOMETRIC PERSONALITY BODY IMAGE VARIABLES (SELECTED FROM THE ORIGINAL 56 VARIABLES) POST-PROGRAMME TEST

(Correlation coefficients greater than 0.273 are significant at the 5% level)

VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
ANTHROPOMETRIC																																		
Weight	1.0																																	
Lean Body Weight	.84	1.0																																
% Body Fat	.66	.16	1.0																															
Endomorphy	.67	.20	.96	1.0																														
Mesomorphy	.15	.08	.34	.38	1.0																													
Ectomorphy	-.46	-.13	-.65	-.66	-.64	1.0																												
Ismail Fitness Score	-.27	.01	-.51	-.51	-.14	.17	1.0																											
PERSONALITY																																		
EPI - N	.00	.01	-.05	-.07	-.08	.00	-.18	1.0																										
- E	.27	.22	.18	.23	.09	-.11	-.15	-.02	1.0																									
- L	-.05	.04	-.16	-.11	-.12	.24	.06	-.23	.00	1.0																								
16PF - A	-.14	-.20	.19	.20	-.00	-.14	.02	-.12	.21	-.07	1.0																							
- B	-.07	-.11	-.00	-.06	.06	.08	-.12	.25	-.04	-.06	-.07	1.0																						
- C	.27	.25	.18	.19	-.08	-.02	.15	-.33	.18	-.03	.16	-.15	1.0																					
- E	.09	.08	.07	.08	.05	-.07	-.09	.12	.51	-.16	.24	.08	-.04	1.0																				
- F	.23	.23	.08	.08	-.02	-.14	-.25	.13	.44	.02	.21	.13	.29	.21	1.0																			
- G	.11	.03	.18	.13	-.08	-.02	-.00	-.00	-.51	.09	-.14	-.07	-.03	-.28	-.39	1.0																		
- H	-.07	-.12	.04	.07	.11	-.20	-.13	-.03	.40	-.17	.44	.09	-.00	.42	.40	-.39	1.0																	
- I	-.23	-.28	-.03	-.08	-.13	.11	-.12	-.03	-.10	-.14	.38	-.18	.03	-.13	.13	-.22	.08	1.0																
- L	-.07	-.10	-.01	.06	.26	-.10	-.14	-.00	.09	.10	-.17	-.16	-.23	.02	-.06	-.11	-.17	-.13	1.0															
- M	-.12	-.20	.05	.02	-.13	.08	-.26	.13	.03	-.16	.17	.22	-.18	.11	-.10	.09	-.07	-.02	-.22	1.0														
- N	.11	-.00	.19	.13	.28	-.22	-.07	.11	-.17	-.06	-.10	.01	.01	-.14	-.02	.26	-.29	-.17	.08	.12	1.0													
- O	.08	-.01	.16	.18	.14	-.11	-.21	.23	.04	.11	.01	.04	-.20	-.07	-.02	.12	-.12	-.16	.12	.12	.35	1.0												
- Q_1	-.06	-.04	-.05	-.04	.06	-.00	-.17	-.04	.14	.08	.12	.18	-.00	.23	.22	-.26	.41	.08	.03	.05	-.10	-.11	1.0										
- Q_2	-.06	-.11	.00	-.00	.13	-.02	-.19	.13	-.21	.09	-.22	-.03	-.30	-.02	-.16	.07	-.16	-.08	.13	.24	.01	.10	.17	1.0									
- Q_3	-.05	-.09	.14	.02	.00	.04	.06	-.32	-.20	-.11	.07	-.17	.16	-.07	-.24	.30	-.04	.19	-.01	-.05	-.31	-.39	.06	.11	1.0								
- Q_4	.02	-.08	.14	.16	.09	-.12	-.22	.25	-.23	.11	-.13	.18	-.35	-.25	-.25	.00	-.27	.04	.00	.09	.02	.25	.10	.18	.09	1.0							
BODY IMAGE																																		
SLADE RUSSELL																																		
Face (Total)	.04	.08	-.02	-.04	-.13	.11	.10	.28	.04	-.06	-.08	-.01	-.04	.21	-.09	-.01	-.23	.00	.04	.01	.12	.03	.08	-.05	-.08	.33	1.0							
Chest (Total)	.12	.08	.12	.13	-.02	.04	-.05	.17	.01	.05	-.08	.22	-.05	.25	-.14	.23	-.29	-.32	.18	.15	.16	.00	-.09	.00	-.07	-.03	-.24	1.0						
Waist (Total)	.09	.00	.16	.20	.16	-.33	-.11	.08	-.09	-.14	.16	.06	.00	-.00	.17	.01	-.08	-.03	.01	.07	.05	-.11	.01	.11	.05	.05	.12	.38	1.0					
Hips (Total)	-.39	-.32	.27	.28	.10	-.32	.07	.02	-.06	.02	-.15	.05	.18	-.13	.07	.18	-.24	-.17	-.04	-.20	.04	.02	-.36	-.09	.00	.08	.06	.40	.54	1.0				
ABACUS																																		
Face (Total)	.07	.09	.00	.04	-.16	.06	-.00	.29	.05	.10	-.02	-.09	-.18	.26	-.04	-.18	-.18	-.08	.11	.08	.09	.01	.06	.16	-.16	.38	.63	.28	.19	.06	1.0			
Chest (Total)	-.03	-.08	.06	.09	-.10	-.05	-.09	.01	.01	-.06	.13	-.18	-.16	.23	-.08	.01	-.13	-.01	.19	-.08	-.00	-.07	-.11	.04	-.00	.02	.11	.29	.26	.13	.44	1.0	
Waist (Total)	.10	.08	.08	.13	.05	-.18	.08	.08	.03	-.00	.25	-.18	-.13	.16	.08	-.07	-.07	.00	.07	-.01	.16	-.04	-.11	.16	-.24	.02	.07	.21	.48	.33	.51	.59	1.0	
Hips (Total)	-.07	-.09	.00	.00	-.01	-.10	.04	.11	-.16	.08	.24	-.11	-.19	.09	-.01	-.08	-.08	.06	.04	.03	.10	.09	-.04	.33	.30	.16	.08	.20	.24	.25	.38	.51	.72	1.0

TABLE 18

SLADE RUSSELL CORRELATIONS BETWEEN DIRECTION OF DISTORTION, MAGNITUDE OF DISTORTION AND RANGE SCORE PRE CONDITIONING PROGRAMME

(Correlation coefficients greater than 0.273 are significant at the 5% level)

	A	B	C	D	E	F	G	H	I	
DIRECTION OF DISTORTION										
Face	1.000									A
Chest	0.523	1.000								B
Waist	0.263	0.503	1.000							C
Hips	0.391	0.544	0.502	1.000						D
MAGNITUDE OF DISTORTION										
Face	0.931	0.399	0.178	0.287	1.000					E
Chest	0.401	0.850	0.322	0.492	0.347	1.000				F
Waist	0.261	0495	0.978	0.474	0.173	0.343	1.000			G
Hips	0.268	0.362	0.440	0.919	0.216	0.405	0.442	1.000		H
RANGE SCORE	0.439	0.571	0.413	0.688	0.284	0.466	0.415	0.572	1.000	I

TABLE 19

ABACUS CORRELATIONS BETWEEN DIRECTION OF DISTORTION, MAGNITUDE OF DISTORTION AND RANGE SCORE FOR ALL SUBJECTS PRE CONDITIONING PROGRAMME

(Correlation coefficients greater than 0.273 are significant at the 5% level)

	A	B	C	D	E	F	G	H	I	
DIRECTION OF DISTORTION										
Face	1.000									A
Chest	0.527	1.000								B
Waist	0.408	0.749	1.000							C
Hips	0.506	0.649	0.724	1.000						D
MAGNITUDE OF DISTORTION										
Face	0.980	0.569	0.435	0.538	1.000					E
Chest	0.3451	0.652	0.425	0.504	0.505	1.000				F
Waist	0.5381	0.596	0.740	0.633	0.428	0.625	1.000			G
Hips	0.369	0.251	0.256	0.581	0.426	0.611	0.591	1.000		H
RANGE SCORE	0.7683	0.770	0.750	0.793	0.708	0.488	0.589	0.369	1.000	I

TABLE 20

SLADE RUSSELL CORRELATIONS BETWEEN DIRECTION OF DISTORTION, MAGNITUDE OF DISTORTION AND RANGE SCORE FOR ALL SUBJECTS POST CONDITIONING PROGRAMME

(Correlation coefficients greater than 0.273 are significant at the 5% level)

	A	B	C	D	E	F	G	H	I	
DIRECTION OF DISTORTION										
Face	1.000									A
Chest	0.497	1.000								B
Waist	0.353	0.733	1.000							C
Hips	0.268	0.697	0.746	1.000						D
MAGNITUDE OF DISTORTION										
Face	0.938	0.371	0.280	0.152	1.000					E
Chest	0.370	0.884	0.699	0.588	0.366	1.000				F
Waist	0.347	0.733	0.995	0.748	0.275	0.706	1.000			G
Hips	0.120	0.561	0.745	0.894	0.064	0.618	0.743	1.000		H
RANGE SCORE	0.525	0.703	0.671	0.673	0.440	0.585	0.671	0.532	1.000	I

TABLE 21

ABACUS CORRELATIONS BETWEEN DIRECTION OF DISTORTION, MAGNITUDE OF DISTORTION AND RANGE SCORE FOR ALL SUBJECTS POST CONDITIONING PROGRAMME

(Correlation coefficients greater than 0.273 are significant at the 5% level)

	A	B	C	D	E	F	G	H	I	
DIRECTION OF DISTORTION										
Face	1.000									A
Chest	0.613	1.000								B
Waist	0.662	0.709	1.000							C
Hips	0.522	0.579	0.770	1.000						D
MAGNITUDE OF DISTORTION										
Face	0.986	0.594	0.661	0.540	1.000					E
Chest	0.337	0.638	0.504	0.506	0.371	1.000				F
Waist	0.619	0.586	0.844	0.717	0.648	0.644	1.000			G
Hips	0.282	0.322	0.522	0.762	0.325	0.559	0.657	1.000		H
RANGE SCORE	0.723	0.766	0.781	0.750	0.704	0.444	0.653	0.441	1.000	I

it requires fewer experimental subjects, and secondly that there is control on their differences, i.e. variability due to differences between subjects can be eliminated from the experimental error.

Repeated measures of analysis of variance tests the null hypothesis by transforming the variables and then analysing linear combinations of their differences. In the paired t-test the transformation is the difference between the values for each subject.

Table 22 contains the repeated measures analysis of variance for the general characteristics of both groups pre- and post-programme. The variables of Age and Height are non-significant. However, the variable of Weight showed significant differences between the groups; the non-exercising group showed no significant differences between their pre- and post-programme measures, whilst the exercising group were observed to have highly significant differences at $p<0.001$ between their pre- and post-programme differences. There were no significant changes again for the non-exercising group on Percentage Body Fat, but the exercising group again showed differences at the $p<0.05$ level on this variable.

In Table 23 the Heath-Carter components are displayed. The Endomorphy component for the exercising group showed a significant decrease in this component, and it was statistically significant at the $p<0.05$ level. On the other two components, Mesomorphy and Ectomorphy, both groups had no significant differences between pre- and post-programme tests.

In Table 24, showing the Ismail Fitness Score, it was observed that there were highly significant differences for both groups between pre- and post-programme results. The non-exercising group

showed a significant decrease in their scores which was statistically significant at the $p<0.001$ level. The exercising group had a significant increase in their scores, which was significant at the $p<0.001$ level.

The EPI Components in Table 25 had differences for both groups between their pre- and post-programme tests on NEUR at the $p<0.05$ level. On the extraversion scale again both groups showed a significant decrease in their scores between their pre- and post-programme tests at the $p<0.01$ level. There were no significant differences on the Lie Scale (psychotism) for both groups.

In Table 26 the 16PF variables are shown and the only statistical significant difference was for Factor E for the non-exercising group. No other factors, although showing a slight difference between their pre- and post-programme scores, were statistically significant.

The Body Image estimates, as measured by the SEA, are displayed in Table 27. On the first measures of the Face, Total and In, there were no differences for both groups, but on the Face In measurement estimated for the non-exercising group there was a significant decrease at the $p<0.01$ level. The non-exercising group again on the Chest Total showed a significant decrease at the $p<0.05$ level between their pre- and post-scores, whilst on the ascending measures of Chest In, both groups showed a significant decrease in their scores, the non- exercising group at $p<0.001$ and the exercising group at the $p<0.01$ levels. On the Waist Total scores the non-exercising group showed a decrease between their scores at the $p<0.05$ level. Again at the ascending waist measures the non-exercising group showed differences that decreased to the $p<0.001$ level. It was observed on the measures of the Hips Total

and the Hips In that again the non-exercising group decreased their pre- to post-programme scores in a significant manner at the $p<0.01$ and $p<0.001$ levels respectively.

The Body Image estimates using the Abacus are shown in Table 28. It was observed that the only statistical differences which are significant are for the non-exercising group on the ascending measurements, i.e. Face In, where a decrease occurred between the pre- and post-programme scores at the $p<0.05$ significance level. All other changes on all four body parts were not statistically significant for the non-exercising group. The exercising group were shown to have three pre- and post-programme measures which were statistically significant between tests. On Face Out measurements it was at the $p<0.001$ level; on the Chest Total at the $p<0.05$ level; and on the Hips Total at the 0.05 level. These measures were all observed to be increases from the pre- to post-programme scores.

4.8. Principal Components Analysis

Principal component analysis is used to simplify the data by replacing the orignal, inter-correlated variables with a set of new variables (the Principal Components) which are uncorrelated with each other. The components are extracted such that each component in order accounts for the maximum remaining variance possible under the constraints that components be uncorrelated (orthogonal).

The technique is most useful when the first few components amount for a large proportion of the total variation in the data.

The Principal Components can be interpreted by examining the weightings of the original variables in the components.

TABLE 22 REPEATED MEASURES OF ANALYSIS OF VARIANCE

GENERAL CHARACTERISTICS OF NON-EXERCISERS AND EXERCISERS, PRE AND POST CONDTIONING PROGRAMME

ANTHROPOMETRIC	PRE		POST		REPEATED MEASURES OF ANOVA		
	X	SD	X	SD	F RATIO	P VALUE	SIGNIFICANCE
AGE							
Non-Exercisers	24.84	5.09	25.16	5.24	2.073	0.171	NS
Exercisers	26.00	5.33	26.08	5.29	2.086	0.161	NS
HEIGHT							
Non-Exercisers	162.67	4.52	162.67	4.53	0.000	1.000	NS
Exercisers	162.32	5.53	162.32	5.53	0.000	1.000	NS
WEIGHT							
Non-Exercisers	59.73	7.28	59.78	7.35	0.014	0.906	NS
Exercisers	57.72	6.10	56.78	5.85	14.439	0.001	***
PERCENTAGE BODY FAT (ESTIMATED)							
Non-Exercisers	27.09	4.40	27.51	4.51	2.331	0.140	NS
Exercisers	25.17	3.85	24.61	4.13	5.520	0.027	*
LEAN BODY WEIGHT (Kg)							
Non-Exercisers	42.98	4.27	43.06	3.80	0.041	0.841	NS
Exercisers	43.10	3.83	42.17	3.54	3.568	0.071	NS

NS: $P>0.05$, *: $0.01<P<0.05$, **: $0.001<P<0.01$, ***: $P<0.001$

TABLE 23 REPEATED MEASURES OF ANALYSIS OF VARIANCE

HEATH-CARTER SOMATOTYPE OF NON-EXERCISERS AND EXERCISERS, PRE AND POST CONDITIONING PROGRAMME

	PRE		POST		REPEATED MEASURES OF ANOVA		
	X	SD	X	SD	F RATIO	P VALUE	SIGNIFICANCE
ENDOMORPHY							
Non-Exercisers	4.72	1.29	4.72	1.32	0.000	1.000	NS
Exercisers	4.02	1.02	3.80	1.02	7.188	0.013	*
MESOMORPHY							
Non-Exercisers	4.64	0.78	4/66	0/83	0.634	0.430	NS
Exercisers	4.80	0.65	4.90	0.93	0.080	0.780	NS
ECTOMORPHY							
Non-Exercisers	2.30	1.20	2.38	1.14	1.000	0.320	NS
Exercisers	2.34	0.71	2.36	0.64	0.041	0.840	NS

NS: P>0.05, *: 0.01<P<0.05, **: 0.001<P<0.01, ***: P<0.001

TABLE 24 REPEATED MEASURES OF ANALYSIS OF VARIANCE

PHYSICAL FITNESS SCORES BASED ON ISMAIL ET AL. CRITERION PRE AND POST CONDITIONING PROGRAMME

	PRE		POST		F RATIO	P VALUE	SIGNIFICANCE
	X	SD	X	SD			
ISMAIL FITNESS SCORE							
Non-Exercisers	196.05	43.63	176.86	40.67	9.98	0.004	**
Exercisers	208.6	34.14	239.61	35.74	50.00	0.000	***

**: 0.001<P<0.01, ***: P<0.001

TABLE 25 REPEATED MEASURES OF ANALYSIS OF VARIANCE

PSYCHOLOGICAL CHARACTERISTICS OF NON-EXERCISERS AND EXERCISERS PRE AND POST CONDITIONING PROGRAMME

EYSENCK EPI	PRE		POST		F RATIO	P VALUE	SIGNIFICANCE
	X	SD	X	SD			
NEUROTICISM-STABILITY							
Non-Exercisers	12.30	3.90	10.52	3.89	5.71	0.025	*
Exercisers	11.28	3.70	9.64	3.84	7.14	0.013	*
INTROVERSION-EXTRAVERSION							
Non-Exercisers	13.88	4.56	11.76	3.69	11.39	0.003	**
Exercisers	13.48	3.96	11.36	3.95	8.50	0.008	**
PSYCHOTISM							
Non-Exercisers	2.28	1.27	2.24	1.06	0.010	0.894	NS
Exercisers	2.44	0.75	2.28	1.04	0.71	0.405	NS

NS: $P>0.05$, * $0.01<P<0.05$, **: $0.01<P<0.01$

TABLE 26 REPEATED MEASURES OF ANALYSIS OF VARIANCE

PSYCHOLOGICAL CHARACTERISTICS OF EXERCISERS AND NON-EXERCISERS PRE AND POST CONDITIONING PROGRAMME (CATTELL 16PF)

CATTELL 16PF VARIABLE	PRE X	PRE SD	POST X	POST SD	F RATIO	P VALUE	SIGNIF.
A. Non-Exerciser	4.88	1.58	4.60	1.91	1.090	0.306	NS
Exerciser	5.16	1.51	4.80	1.72	1.620	0.210	NS
B. Non-Exerciser	6.52	1.52	7.00	1.52	2.370	0.136	NS
Exerciser	5.36	1.95	5.88	1.94	2.690	0.114	NS
C. Non-Exerciser	5.32	1.46	5.40	1.32	0.107	0.746	NS
Exerciser	5.60	1.62	5.96	1.42	1.690	0.205	NS
E. Non-Exerciser	5.80	2.48	6.60	2.56	5.260	0.031	*
Exerciser	5.72	2.32	6.44	2.08	3.010	0.095	NS
F. Non-Exerciser	5.60	1.64	5.68	1.64	0.137	0.714	NS
Exerciser	6.04	1.48	5.56	2.00	2.540	0.123	NS
G. Non-Exerciser	4.56	1.38	4.56	1.60	0.000	1.000	NS
Exerciser	4.36	1.41	4.52	1.94	0.354	0.557	NS
H. Non-Exerciser	5.16	1.48	5.20	1.67	0.045	0.832	NS
Exerciser	4.76	1.68	5.20	1.74	2.140	0.156	NS
I. Non-Exerciser	4.16	1.82	4.84	1.97	3.770	0.064	NS
Exerciser	5.16	1.82	4.84	1.91	1.060	0.311	NS
L. Non-Exerciser	6.44	1.38	6.76	1.27	2.620	0.119	NS
Exerciser	6.28	1.24	6.00	2.05	0.700	0.410	NS
M. Non-Exerciser	5.36	1.49	5.60	1.78	0.850	0.365	NS
Exerciser	4.96	1.53	4.76	1.17	0.750	0.390	NS
N. Non-Exerciser	5.76	2.00	5.52	1.74	0.683	0.417	NS
Exerciser	5.76	1.60	5.40	1.78	1.250	0.273	NS
O. Non-Exerciser	4.80	1.69	4.96	1.98	0.324	0.574	NS
Exerciser	5.48	1.52	4.92	1.89	2.290	0.143	NS
Q1. Non-Exerciser	6.64	1.64	6.88	1.63	0.633	0.434	NS
Exerciser	6.64	1.87	6.48	2.17	0.151	0.701	NS
Q2. Non-Exerciser	5.64	1.69	5.84	1.78	1.000	0.327	NS
Exerciser	5.08	2.11	5.36	2.41	0.701	0.410	NS
Q3. Non-Exerciser	4.88	1.60	4.76	1.65	0.137	0.714	NS
Exerciser	5.14	2.04	4.80	1.76	0.429	0.519	NS
Q4. Non-Exerciser	6.52	1.20	6.28	1.61	0.570	0.457	NS
Exerciser	6.04	1.58	5.56	1.49	1.600	0.218	NS

NS: $P>0.05$, *: $0.01<P<0.05$

TABLE 27 REPEATED MEASURES ANALYSIS OF VARIANCE

SLADE RUSSELL APPARATUS BODY IMAGE CHARACTERISTICS OF NON EXERCISERS AND EXERCISERS PRE AND POST CONDITIONING PROGRAMME

	PRE		POST		F RATIO	P VALUE	SIGNIF.
	X	SD	X	SD			
FACE - TOTAL							
Non-Exerciser	137.46	18.46	131.75	21.4	1.64	0.212	NS
Exerciser	127.92	24.23	128.74	13.0	0.213	0.648	NS
FACE-OUT							
Non-Exerciser	124.12	17.24	128.5	20.81	1.05	0.315	NS
Exerciser	117.07	22.51	125.07	27.72	3.98	0.057	NS
FACE - IN							
Non-Exerciser	150.75	24.96	135.04	24.56	8.21	0.009	**
Exerciser	138.75	27.57	132.39	33.38	0.85	0.366	NS
CHEST - TOTAL							
Non-Exerciser	130.44	17.53	124.34	16.63	6.12	0.021	*
Exerciser	116.48	16.24	114.87	13.87	0.622	0.438	NS
CHEST - OUT							
Non-Exerciser	117.89	17.78	119.22	15.39	0.226	0.638	NS
Exerciser	106.54	14.92	113.44	14.60	2.39	0.135	NS
CHEST - IN							
Non-Exerciser	143.06	19.72	128.76	20.44	15.76	0.001	***
Exerciser	126.40	19.66	116.34	14.31	9.20	0.006	**
WAIST - TOTAL							
Non-Exerciser	132.53	14.06	124.97	12.48	5.50	0.028	*
Exerciser	120.86	14.07	121.43	12.12	0.046	0.831	NS
WAIST - OUT							
Non-Exerciser	122.63	16.26	122.21	12.06	0.128	0.723	NS
Exerciser	114.42	15.85	119.71	12.76	1.34	0.257	NS
WAIST - IN							
Non-Exerciser	142.35	14.42	127.73	15.13	16.63	0.000	***
Exerciser	127.33	15.46	123.16	13.26	2.19	0.152	NS
HIPS - TOTAL							
Non-Exerciser	119.88	12.68	113.87	10.44	7.52	0.011	**
Exerciser	113.26	15.15	112.03	12.53	0.223	0.641	NS
HIPS - OUT							
Non-Exerciser	111.48	14.01	109.99	9.74	3.27	0.083	NS
Exerciser	106.87	14.76	111.70	13.09	0.131	0.720	NS
HIPS - IN							
Non-Exerciser	128.77	13.79	117.76	12.90	15.67	0.001	***
Exerciser	119.67	17.52	112.33	13.13	2.44	0.131	NS

NS: $p>0.05$, *: $0.01<p<0.05$, **: $0.001<p<0.01$, ***: $p<0.001$

TABLE 28 REPEATED MEASURES ANALYSIS OF VARIANCE

ABACUS BODY IMAGE CHARACTERISTICS OF NON-EXERCISERS AND EXERCISERS PRE AND POST CONDITIONING PROGRAMME

ABACUS	PRE X	PRE SD	POST X	POST SD	F RATIO	P VALUE	SIGNIF.
FACE - TOTAL							
Non-Exercisers	175.95	25.87	170.66	26.67	0.938	0.342	NS
Exercisers	152.02	28.47	161.31	39.53	3.81	0.063	NS
FACE - OUT							
Non-Exercisers	144.84	29.70	153.33	29.34	2.66	0.116	NS
Exercisers	123.22	25.18	141.08	41.53	15.34	0.001	***
FACE - IN							
Non-Exercisers	206.7	31.32	188.02	33.76	7.121	0.013	*
Exercisers	180.7	39.31	181.55	41.24	0.016	0.900	NS
CHEST - TOTAL							
Non-Exercisers	117.35	18.78	116.47	17.07	0.639	0.423	NS
Exercisers	107.64	11.67	109.44	16.95	7.26	0.013	*
CHEST - OUT							
Non-Exercisers	105.17	18.45	108.57	17.15	0.508	0.483	NS
Exercisers	93.90	16.55	100.98	19.92	0.178	0.676	NS
CHEST - IN							
Non-Exercisers	129.51	24.26	124.34	21.64	2.91	0.101	NS
Exercisers	121.26	12.42	117.89	17.71	0.106	0.747	NS
WAIST - TOTAL							
Non-Exercisers	121.08	16.02	120.3	17.5	0.013	0.909	NS
Exercisers	115.95	15.64	116.23	19.7	0.495	0.488	NS
WAIST - OUT							
Non-Exercisers	107.11	18.09	111.35	18.09	0.086	0.771	NS
Exercisers	98.17	21.19	104.82	23.25	0.756	0.393	NS
WAIST - IN							
Non-Exercisers	135.05	20.36	129.14	21.46	1.43	0.243	NS
Exercisers	133.74	17.47	127.66	20.85	2.04	0.166	NS
HIPS - TOTAL							
Non-Exercisers	110.8	14.94	111.32	14.87	0.792	0.382	NS
Exercisers	109.61	10.56	113.39	13.33	5.46	0.028	*
HIPS - OUT							
Non-Exercisers	96.96	14.95	102.94	13.99	0.443	0.512	NS
Exercisers	95.63	15.55	100.54	15.92	0.464	0.502	NS
HIPS - IN							
Non-Exercisers	121.45	13.34	119.68	17.97	0.005	0.941	NS
Exercisers	123.60	12.55	126.5	13.58	2.42	0.132	NS

NS: $P>0.05$, *: $0.01<P<0.05$, **: $0.001<P<0.01$, ***: $P<0.001$

Principal Components Analysis was used in this study:-

(a) to investigate inter-relationships amongst the original variables

(b) to identify the major direction of variation in:-

(i) personality

(ii) body image

(iii) somatotype

in order to look at correlations between these components. This statistical technique is an alternative to canonical correlation analysis, which is not used here because it is highly sensitive to departures from normality in the data.

Each subject can be given a principal components score and this is given by the following formula:-

$$\text{P C Score} = \sum_{i=1}^{P} w_i \; x_i$$

p variables sum over all p variables of the product of the weightings w_i and the value for the variables x_i expressed as deviation from the mean for that variable.

Principal Components Analysis entails calculating the weightings w_i.

In Table 29 the principal component coefficients for the personality factors of the EPI and the 16PF are displayed. On Principal Component 1 (PC1), which accounts for 25.5% of the variance, the highest negative weighted score is the extraversion. So PC1 represents extraversion (negative PC1 score) vs. neuroticism (positive PC1 score). People who have scored highly on the extraversion factor on the EPI will have a low score on the neuroticism score.

On Principal Component 2 (PC2), which accounts for 19.5% of the total variance, a high positive loading is observed on the neuroticism factor of the EPI and Factor E of the 16PF, suggesting that subjects with high scores on PC2 are high on the neurotic scale and are also aggressive. Principal Components 3, 4 and 5 account for a small proportion of total variance.

In Table 30 the principal component coefficients for body image, as measured by the SEA, are contained. All Body Image I variables have positive loadings on Principal Component 1 (which accounts for 50.7% of the variance) illustrating that the major trend in the data is of overall body image perception. The biggest source of variation between subjects is overall ability to estimate their body image, i.e. people either do well or badly at all body image tests.

When the principal component 2 (PC2) coefficients are examined, the face variables are all positively loaded, whilst the chest, waist and hips have negative weightings. This indicated that subjects on all trials had difficulty in estimating their face widths, but on the other body parts managed to be more accurate in their estimations or vice versa. The principal components 3 and 4 account for a small proportion of total variance but would indicate subjects being often less accurate when estimating the face, waist and hips, but tend to be more accurate when estimating their chest, or vice versa.

In Table 31 are displayed the principal component coefficients for body image as measured by the Abacus. All Body Image II have positive loadings again, as in Body Image I. This illustrates that the major trend in the data is of overall body image perception, whilst the large variation between subjects is overall ability to

estimate their body image. Principal components 2, 3 and 4 account for a relatively small proportion of the total variance. All these components tend to have high positive loadings on the face, but negative loadings on the other three body parts. This illustrates subjects over-estimating their face widths and being more accurate on their chest, waist and hips, or vice versa.

In Table 32 the principal component analysis coefficients of the Heath-Carter somatotype are shown. The analysis of the somatotype was done to replace the three variables with one. Principal Component 1 accounts for 76% of the variance and illustrates a high positive loading of Endomorphy and Mesomorphy, and a negative loading on Ectomorphy.

The principal component scores for all subjects were correlated by the Pearson Product Moment Coefficient and the correlations are shown in Table 33 . With 48 degrees of freedom correlations of 0.273 are required for significance at the $p<0.05$ level.

Among the principal components it was observed that Body Image I (SEA) and Body Image I (A) did not correlate well with the principal component coefficients of personality. However, Body Image I (3) correlated with Personality (PCII); Personality (PC3) and Body Image I (5) had a positive correlation with Personality (4) all at the $p<0.05$ level of significance.

The principal component coefficients of Body Image 2 (Abacus) were observed to have the following positive correlations at the $p<0.05$ level; Body Image 2 (I) with Personality 2, Body Image 2 (5) with Personality 3. The principal component of Somatotype (SOMA) had a positive correlation at the $p<0.05$ level with Body Image 2 (3); and a positive correlation with Body Image 1 (2), but was not significant.

TABLE 29 PRINCIPAL COMPONENTS ANALYSIS OF PERSONALITY VARIABLES

% OF VARIANCE ACCOUNTED FOR	1 25.5	2 19.1	3 9.4	4 6.4	5 5.5
EYSENCK PFI					
NEUR	0.215	0.876	0.133	0.237	0.124
EXT.	-0.757	0.280	-0.329	-0.282	-0.154
LIEC.	0.011	-0.050	-0.037	-0.095	-0.022
CATTELL 16PF					
A	-0.146	-0.031	0.016	0.348	-0.203
B	0.010	0.048	0.220	0.060	-0.150
C	-0.087	-0.119	-0.087	0.074	0.004
E	-0.264	0.037	0.501	-0.072	0.059
F	-0.200	0.087	-0.049	0.168	0.137
G	0.162	-0.044	-0.126	-0.070	0.057
H	-0.221	-0.025	0.140	0.165	-0.013
I	-0.008	-0.098	0.019	0.522	-0.286
L	0.022	0.051	0.032	-0.131	0.344
M	0.032	0.012	0.105	-0.112	-0.444
N	0.091	0.081	-0.239	-0.123	-0.143
O	0.047	0.179	-0.187	-0.101	-0.202
Q_1	-0.096	-0.014	0.267	-0.017	-0.169
Q_2	0.153	0.039	0.315	-0.427	-0.173
Q_3	0.067	-0.199	-0.002	0.092	0.153
Q_4	0.090	0.093	-0.051	0.001	-0.228

TABLE 30 PRINCIPAL COMPONENTS ANALYSIS OF BODY IMAGE (SLADE RUSSELL)

% VARIANCE ACCOUNTED FOR	1 50.70	2 24.70	3 8.70	4 7.70
FACE				
Total	0.451	0.350	0.048	0.066
Out	0.349	0.350	-0.190	0.429
In	0.545	0.343	0.285	-0.293
CHEST				
Total	0.266	-0.257	-0.440	-0.111
Out	0.178	-0.148	-0.461	0.083
In	0.344	-0.334	-0.354	-0.389
WAIST				
Total	0.186	-0.302	0.179	0.382
Out	0.139	-0.244	0.005	0.531
In	0.224	-0.350	0.345	0.172
HIPS				
Total	0.129	-0.236	0.230	-0.087
Out	0.065	-0.179	0.102	0.073
In	0.170	-0.272	0.364	-0.288

TABLE 31 PRINCIPAL COMPONENTS ANALYSIS OF BODY IMAGE (ABACUS)

% VARIANCE ACCOUNTED FOR	1 62.9	2 12.4	3 10.7	4 4.8
FACE				
Total	0.540	0.092	0.225	0.020
Out	0.445	-0.399	0.619	-0.143
In	0.613	0.566	-0.246	0.201
CHEST				
Total	0.127	-0.255	-0.109	-0.198
Out	0.034	-0.236	-0.027	0.356
In	0.166	-0.147	-0.333	-0.572
WAIST				
Total	0.145	-0.381	-0.186	0.028
Out	0.063	-0.285	-0.075	0.502
In	0.199	-0.238	-0.478	-0.126
HIPS				
Total	0.084	-0.224	-0.133	0.143
Out	-0.004	-0.140	-0.079	0.372
In	0.127	-0.117	-0.294	0.127

TABLE 32

PRINCIPAL COMPONENTS ANALYSIS OF HEATH-CARTER SOMATOTYPE

% VARIANCE ACCOUNTED FOR	1 76.25	2 17.65
ENDOMORPHY	0.759	0.611
MESOMORPHY	0.336	-0.660
ECTOMORPHY	-0.556	0.434

TABLE 33 CORRELATION MATRIX OF PRINCIPAL COMPONENTS SCORES OF PERSONALITY, BODY IMAGE AND HEATH-CARTER SOMATOTYPE

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	
PCIP	1.00																A
PC2P	-0.00	1.00															B
PC3P	-0.00	-0.00	1.00														C
PC4P	0.00	-0.00	-0.00	1.00													D
PC5P	-0.00	-0.00	-0.00	0.00	1.00												E
PC1BI1	0.04	0.18	0.04	-0.17	0.02	1.00											F
PC2BI1	-0.00	0.04	0.01	0.05	-0.1	-0.00	1.00										G
PC3BI1	0.05	-0.22	0.22	0.06	-0.07	0.00	0.00	1.00									H
PC4BI1	0.08	0.12	-0.09	-0.18	-0.09	0.00	-0.00	0.00	1.00								I
PC5BI1	-0.05	0.11	-0.04	0.24	-0.07	0.00	0.00	-0.00	-0.00	1.00							J
PC1BI2	-0.06	0.28	-0.07	0.02	-0.12	0.35	0.07	-0.12	-0.03	0.04	1.00						K
PC2BI2	0.11	0.11	-0.03	-0.05	-0.03	0.24	0.28	-0.03	0.00	0.16	-0.00	1.00					L
PC3BI2	-0.12	0.02	-0.28	-0.15	0.17	0.01	0.33	-0.13	0.13	0.05	0.00	-0.00	1.00				M
PC4BI2	0.08	0.04	0.14	0.09	-0.25	0.09	0.21	0.36	0.17	-0.07	0.00	0.00	0.00	1.00			N
PC5BI2	-0.12	0.06	0.28	-0.06	0.05	-0.08	0.06	0.16	0.19	0.04	-0.00	-0.00	-0.00	0.00	1.00		O
SOMA	-0.10	0.20	0.18	-0.14	0.04	0.23	-0.23	-0.02	0.00	0.01	0.09	0.18	-0.27	-0.15	-0.00	1.00	P

4.9. Discriminant Analysis

Discriminant analysis is used to find which variables, or combination of variables, are most useful in discriminating between groups (treated vs. untreated groups).

This is complicated by the fact that some variables, although not significantly different pre- and post-treatment when considered singly, are nevertheless useful discriminants when combined with others. At the same time, many variables may vary significantly between groups, but there is redundancy because they are inter-correlated.

Discriminant analysis finds linear combinations of variables which maximise the ratio of between - to within - groups variance.

The absolute values of the discriminant coefficients (variable loadings) when they have been standardised to compensate for differences in scale and variability among the original variables, indicate the relative importance of each variable in discrimination.

Groups with characteristically high measured values or negatively weighted variables will tend to have negative discriminant scores, i.e. discriminant scores are sums of products of weightings and measurements.

The data from this study was analysed using the SPSS-X discriminant analysis program. For the purpose of this study, the untreated groups were deemed to be Group 1 (pre-non-exercising group), Group 2 (pre-exercising group) and Group 3 (post non-exercising group) vs. the treated group, Group 4 (post exercise group).

The standardised canonical discriminant function coefficients of the anthropometric data are shown in Table 34. The high positive

loadings are indicative of the effect of treatment (in Table 35 the treated group have a high positive group mean). The treated group are observed to be highly weighted on the Ismail Score and the Somatotype component of Mesomorphy. Group 4 are also low on Percentage Body Fat and Weight. The untreated groups have low weightings on the Ismail Fitness Score.

In Table 36 it is illustrated that the variable with the most discriminating power between the untreated groups and the treated groups is the Ismail Fitness Score.

For the personality domain, standardised personality coefficients are shown in Tables 37-38. The untreated group have a high negative weighting on Cattell's Factor E. The untreated group had high weightings on the EPI Extraversion and the 16PF Factors L, M, O and Q_4.

In Table 39 the 16PF Factor Q_4 is the variable which best discriminates the untreated groups from the treated groups. The treated group's low score is largely due to the fact that at the end of the conditioning programme they were less tense.

The Body Image estimates as measured both by the SEA and Abacus are displayed in Tables 40-41. The untreated groups had positive loadings whilst the treated group had negative weightings. The treated group were observed to score highly on the variables (SEA) in highly weighted coefficients; Hips Total, Waist Total, Face Total; on the Abacus Hips Out; Face Out; Waist In; Face In. On the other hand, the untreated group had highly weighted coefficients on the SEA Hips Out, Face In and Face Out; and on the Abacus on Chest Out, Face Total and Chest In.

The variable which most discriminated between the untreated groups and the treated group in Table 42 is Chest In, as measured by the SEA.

TABLE 34

ANTHROPOMETRIC DATA - STANDARDISED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

VARIABLES	FUNCTION I
Weight (kg)	-0.459
Lean Body Weight (kg)	0.343
Percentage Body Fat	-1.556
Endomorphy	-1.476
Mesomorphy	0.345
Ectomorphy	0.175
Ismail Fitness Score	0.955

TABLE 35

CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS. GROUPS 1,2,3 VS. GROUP 4 (TREATED GROUP) (ANTHROPOMETRIC)

	N	FUNCTION I
GROUPS 1,2,3	75	-0.338
GROUP 4	25	1.016

TABLE 36

ANTHROPOMETRIC DATA - STRUCTURE MATRIX POOLED WITHIN GROUPS.

CORRELATIONS BETWEEN DISCRIMINATING VARIABLES AND CANONICAL DISCRIMINANT FUNCTIONS.

(VARIABLES ORDERED BY SIZE OF CORRELATION WITHIN FUNCTION)

VARIABLES	FUNCTION I
Ismail Fitness Score	0.833
Endomorphy	-0.413
Percentage Body Fat	-0.334
Weight	-0.249
Mesomorphy	0.065
Lean Body Weight	-0.065
Ectomorphy	0.015

TABLE 37

PERSONALITY - STANDARDISED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

VARIABLES		FUNCTION 1
EPI	N	0.389
	E	0.902
	L	0.104
16PF	A	0.181
	B	0.325
	C	-0.008
	E	-0.276
	F	0.048
	G	0.338
	H	0.030
	I	0.145
	L	0.565
	M	0.389
	N	0.158
	O	0.346
	Q_1	0.008
	Q_2	0.203
	Q_3	0.224
	Q_4	0.441

TABLE 38

PERSONALITY - CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS, GROUPS 1,2,3 VS. GROUP 4

	N	FUNCTION I
GROUP 1,2,3,	75	0.310
GROUP 4	25	-0.931

TABLE 39

PERSONALITY POOLED WITHIN GROUPS CORRELATIONS BETWEEN DISCRIMINATING VARIABLES AND CANONICAL DISCRIMINANT FUNCTIONS

(VARIABLES ORDER BY SIZE OF CORRELATION WITHIN FUNCTION)

VARIABLE	FUNCTION
Q_4	0.384
E	0.354
N	0.352
M	0.284
C	-0.282
L	0.255
B	0.178
E	-0.124
N	0.124
Q_1	0.103
F	0.099
H	-0.076
O	0.070
Q_2	0.062
I	-0.049
Q_3	0.041
A	0.037
L(E)	0.030
G	-0.013

TABLE 40

BODY IMAGE - STANDARDISED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

VARIABLES		FUNCTION I
SLADE RUSSELL		
Face	Total	-3.644
	In	2.018
	Out	1.829
Chest	Total	-0.271
	In	-0.108
	Out	0.664
Waist	Total	-0.797
	In	0.288
	Out	0.229
Hips	Total	-1.897
	In	-0.092
	Out	2.350
ABACUS		
Face	Total	1.249
	In	-0.505
	Out	-0.800
Chest	Total	-1.551
	In	0.768
	Out	1.348
Waist	Total	0.386
	In	-0.658
	Out	0.969
Hips	Total	0.491
	In	0.193
	Out	-1.414

TABLE 41

BODY IMAGE - CANONICAL DISCRIMINANT FUNCTIONS EVALUATED AT GROUP MEANS. GROUPS 1,2,3 VS. GROUP 4

	N	FUNCTION I
Groups 1,2,3,	75	0.502
Group 4	25	-1.506

TABLE 42

BODY IMAGE - POOLED WITHIN GROUPS CORRELATIONS BETWEEN DISCRIMINATING VARIABLES AND CANONICAL DISCRIMINANT FUNCTIONS

VARIABLES		FUNCTION I
(SEA)	Chest In	0.386
(SEA)	Waist In	0.289
(SEA)	Hips In	0.255
(SEA)	Chest Total	0.230
(AB)	Chest In	0.176
(SEA)	Waist Total	0.170
(AB)	Hips In	-0.154
(AB)	Waist Out	-0.152
(AB)	Hips total	-0.147
(AB)	Waist In	.144
(AB)	Face In	0.130
(SEA)	Face Out	-0.129
(SEA)	Face In	0.107
(SEA)	Hips Total	0.099
(SEA)	Hips Out	-0.077
(AB)	Face Total	0.056
(SEA)	Chest Out	0.056
(AB)	Face Out	-0.053
(AB)	Chest Total	0.048
(AB)	Hips Out	-0.045
(SEA)	Waist Out	0.039
(AB)	Waist Total	0.037
(AB)	Chest Out	-0.036
(SEA)	Face Total	0.000

4.10. Summary

The results of this investigation demonstrate that subjects who participate in a conditioning programme undergo the following anthropometric, personality and body image changes:-

(i) increase in weight

(ii) decrease in percentage body fat

(iii) decrease in the Heath-Carter component of Endomorphy

(iv) an increase on their fitness score as measured by the criterion of Ismail *et al*.

(v) a reduction on the EPI factor of neuroticism

(vi) a reduction on the 16PF factor Q_4

(vii) on the SEA and Abacus estimates of body image they were more accurate and their range of responses was smaller.

The association of the domains of personality and body image would seem to have an inter-relationship between the principal component scores:-

(i) principal components of body image (SEA) correlated with principal components of personality

(ii) principal components of body image (Abacus) correlated with principal components of personality

The factors which best discriminated between a non-exercising group and exercising group are:-

(i) Ismail Fitness Score

(ii) Cattell's 16PF Factor Q_4

(iii) Chest In as measured by the SEA.

4.11. Null Hypotheses

Hypothesis I

That there will be no significant differences of measures of postural body image, as measured by the Slade Russell Estimation Apparatus, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme, was held tenable.

Hypothesis II

That there will be no significant differences of measures of postural body image, as measured by a novel apparatus (an Abacus), between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme, was held tenable.

In the case of body image measured by both the SEA and the Abacus these two hypotheses were held tenable between a non-exercising and exercising group of women. The results of the data would suggest that postural image is not an "all or nothing" phenomenon but that distortion may occur in one body part or another. It was observed that the non-exercising group have a greater range of responses on all body parts and significantly tend to over-estimate all body widths. Although no statistically significant difference between the two groups was shown in the analyses of the data, a trend was demonstrated that the exercise group exhibited a more positive conception of their body image.

Hypothesis III

That there will be no significant differences of measures of somatotype, as measured by the Heath-Carter method, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme, was rejected at the $p<0.05$ level of significance.

The Heath-Carter Somatotype component of Endomorphy was significantly decreased on the post-programme tests of the exercising group. The women in the exercising group were observed to increase their scores on the Mesomorphy component but this was not statistically significant.

Hypothesis IV

That there will be no significant differences of measures of personality, as measured by the Eysenk Personality Inventory and the Cattell Sixteen Personality Factor Questionnaire, between a group of non-exercising women and a group of women who have taken part in a twelve-week conditioning programme was held tenable.

Both groups, on their pre- and post-programme tests had statistically signficant differences at the $p<0.05$ level on the EPI Factor of Neuroticism, and on the Extraversion scale both groups at the $p<0.01$ level decreased their scores at the post-programme tests.

The most statistically significant difference between the groups was the Ismail Fitness Score at the pre- and post-programme tests. There was no difference between the groups when tested at the pre-programme, but at the post-programme tests the non-exercising group had significantly ($p<0.001$) decreased their fitness score, whilst the exercise group had significantly ($p<0.001$) increased their fitness scores.

SECTION 5

DISCUSSION

SECTION 5

DISCUSSION

The purpose of this study was to explore the relationships between body image and personality, and the effect on these domains of participating in a conditioning programme. It was hypothesised that in comparison to a group of non-exercising women, a group of women who engaged in a 12-week conditioning programme would be more accurate and articulate in their concept of postural body image. In the personality domain, as measured by the EPI and the 16PF, exercising women would be observed to undergo some measurable changes. Finally, that by involvement in an exercise regime, there would be changes in somatotype components as measured by the Heath-Carter method.

5.1. Postural Body Image

It was found that, compared with women who had participated in an exercise programme, non-exercising women had an inaccurate knowledge of the width of some of their body parts and a less well-articulated postural body image. The use of both the SEA and the Abacus demonstrated that the non-exercisers in the main tended to over-estimate the size of their body parts, and in particular to over-estimate their face and chest. In general, findings are consistent with those reported by Schultz (1961), Cremer and Hukill (1969) and Ward and McKeown (1988).

It would appear from the findings that many subjects experience difficulty in what they perceive (accuracy of perception). On the other hand, most of the non-exercising group had difficulty in perceiving their postural body image. There was seen to be a large

range of responses by the non-exercising group on all of the body widths; it would appear that their particular perceptual style was not as well articulated as that of women who participated in a conditioning programme.

We can analyse perceptual style in Piaget's (1954) stages of cognitive development. Piaget postulated three major discrete stages in development:-

1. the sensory motor stage
2. the stage of concrete operations, and
3. the stage of formal operations.

As a child progresses through these stages, it moves from the undifferentiated state of sensations and reflexes, which characterises the sensory motor stage to the more differentiated but concrete mode of thought, which includes crude symbolic categories of the concrete operational phase. Finally, in the stage of formal operations, the pre-adolescent is able to apply concrete operations to hypothetical situations and to manipulate abstractions.

The cognitive schema progress during the three stages from action, to internalised mental presentations of the action, to abstractions which are detached from the concrete object.

In using the SEA, the subjects are required to project on to a neutral object their conceptualisation of their body image. This task assumes that the body image of each subject is functioning at the formal operational phase of conceptual development.

The body image has been built up through interaction with the environment with past actions. The actual touching, moving or looking at the body (concrete operations) are, because of maturity, no longer required in order to do mental "gymnastics" and concept-

ualise the body image, and project it on to a neutral object such as the SEA. A subject would be unable to perform the perceptual task required by the SEA if she did not have a clear representation of her body image.

When the body image concept is investigated it would seem that, in order for it to be accurate and well-articulated, the individual needs to be aware of the relationship of the body to its environment. The body image by its function is a bounded image which is formed as a function of the interaction and subsequent separation of the self from the rest of the world. Interaction and knowledge of self, in relationship to the environment, requires movement.

The findings from this study would suggest that women who engage in physical activity have a greater self-awareness, as exemplified by lower scores on the first principal components of body image - SEA or Abacus - which are components associated with overall body imaging accuracy. Physical activity has a greater self-awareness enhancing property which presents frequently the opportunity to perceive via feedback from one's senses and the environment. It activates the relationship between one's actions and their impact on people and objects, and leads to greater self-awareness.

On the other hand, a more simplistic explanation for the observed improvement in body image accuracy with exercise could be constructed in terms of differences in perceptual style.

It is claimed by some people that due to, for example social pressures, women are more prone to over-estimate their body size and shape than men. Among the subjects of the current study, many comments made by the women tended to confirm this view. It could be said that this is an English characteristic, in particular a north

of England trait, i.e. to under-estimate one's good points. The findings of North American studies, i.e. Kessler (1978) could not be applied to English women, for although there has been a great upsurge in "looking good", the cultural differences are insurmountable.

5.2. Somatotype

The subjects who participated in this study were somatotyped according to the Heath-Carter method. At the pre-programme tests there were no significant differences between the two groups. When the subjects were measured at the post-programme tests there were significant differences between the two groups. The exercising group were observed to have a significant decrease in body fat which was consistent with the findings of Moody et al (1972), Gwinup (1975), Lesmes et al (1976) and Williams and Morton (1988). As a consequence of the reduction in the percentage body fat, the Endomorphy component decreased and there was an increase in the component of Mesomorphy. To complement these changes the exercisers showed a trend to a reduction in body weight at the end of the programme. These findings are significant to promote the participation of adult women in a vigorous exercise regime. Many women spend their lives on various diets and engage in numerous "fitness" classes to achieve weight loss. This study demonstrates unequivocally that in order to lose percentage fat and firm up it is necessary to exercise three times per week for a minimum of 50 minutes and to ensure that jogging/running is an integral part of the fitness regime. It is clearly demonstrated that these changes in the components of somatotype, decreases in percentage body fat and body weight loss, can be achieved at the end of a 12 week

period. The only satisfactory reason for compliance among the subjects engaged in the programme was the realisation that these changes were taking place.

5.3. Personality

The personality domain was investigated by the use of the Eysenck Personality Inventory and the Cattell Sixteen Personality Questionnaire, in order to replicate the method of Young and Ismail (1973).

There were no differences in pre-programme tests on the factors of personality. When the post-programme test data was analysed it was shown that on the EPI both groups showed a signficant decreae on the neuroticism and extraversion scale. It would appear that, similar to the findings of Tattersfield (1971), participation in an exercise regime does not affect the personality domain as many sports psychologists have claimed in the past. On the 16PF the most significant change was on the factor Q_4 (phlegmatic and composed vs. tense and excitable); the exercising group had a lower mean score at the post-programme groups, consistent with Tillman (1965). Using discriminant analysis Factor Q_4 was the coefficient which best discriminated between the two groups. The non-exercising group showed a significant change between their pre- and post-programme tests on Factor E (assertive and indepenent vs. humble and mild) indicating that on their second visit to the laboratory they were more assertive. This would suggest that on their initial visit to the laboratory they did not display their true characteristics. The personality factors of adult women are not as plastic as researchers would seem to have indicated in the past. Most people's personality traits are well-established by adult-hood. Many of the

questionnaires are not as sensitive to subtle changes as investigators would postulate. The meeting of a group of people three times per week to engage in an exercise regime would suggest that a mental toughness is needed to achieve this task. The time span of twelve weeks would not be sufficient to bring about changes in the personality domain. It is obvious that changes in personality are not brought about by participation in a conditioning programme, but may be manifested by the growth of confidence that people achieve when they realise that physiological changes are occurring. As a result "fitter" people are able to display to all the full range of traits they have in the personality domain. The results obtained in this study can be compared with those of a similar study on men by Ismail and Young (1973). They found significant differences between post-conditioning programme 'high-fit' and 'low fit' groups in Cattell's 16PF Factors M, O and Q_2. Factor C was also useful in discriminating between these groups. In the current study, Factor E was the only significant difference between pre- and post-programme results of exercising women, while Factor Q_4 was found to be the best discriminator between a non-exercising group and an exercising group.

However, different statistical methodologies were used by Ismail and Young. They did not carry out repeated measures of analysis of variance and only four personality variables, chosen by the authors, were entered into discriminant analysis. This makes comparison of the study results difficult. Also important is the fact that both their groups participated in the conditioning programme. In Ismail and Youngs' Tables 3 and 4, changes in Q_4 after treatment (post-conditioning programme) can be observed, and

they may have been found to be significant in a repeated measures of analysis of variance.

The relationship between body image and personality was clearly demonstrated by means of the principal components and correlation analyses. The link between personality and body image has been one of the areas of research which has eluded investigators for many years. Although this study was able to suggest that such links do exist, by correlating and analysing the scores obtained in the personality domain by the EPI and 16PF, and in the body image domain using the SEA and the Abacus, the measurement of both these two domains still seemed elusive. Although many studies have used the questionnaires to measure personality traits, the personality domain is still difficult to quantify. Personality is such a multi-facet domain that one form of measurement does not assess a person's total personality.

Many of the personality variables studied are inter-correlated. This should be borne in mind when interpreting the results of univariate tests (e.g. analysis of variance on each variable separately). Personality cannot be measured simply on a single variable. Many variables mush be measured to assess personality, but the correlations show that these may be highly inter-related, so there is some redundancy or repeated information. By using principal components analysis, the underlying dimensions of personality may be identified and characterised.

The measurement of personality is best achieved by questionnaires, interviews and situtational techniques. The subtle changes which personality undergoes may be best ascertained by subjects being given check lists and asked to note their changes in moods and emotions whilst they are exercising.

Five principal components of personality were studied. None of the five principal components extracted from the SEA body image variables were significantly correlated with any of the personality components. However, significant relationships were found between principal components of body image, as measured by the Abacus, and personality.

a) Abacus body image component 1 is postively correlated with personality component 2 (EPI, N, E^+ vs. Cattell's C, E^-). This is overall body image inaccuracy associated with neuroticism/extraversion, and body image accuracy with mature/calmness, conscientious/persistent. (Personality component 2 characterised by negative loadings on Cattell 16PF Factors C and E, positive loadings on Eysenck N and E).

b) Abacus body image component 2 is negatively correlated with personality component 3, indicating an association between accuracy on the face and inaccuracy on the rest of the body on the one hand, and dominant/aggressive, self-sufficient/resourceful personality traits on the other. Abacus body image component 2 has positive loadings on Face Total and Face In, and negative loadings on all other variables. Personality component 3 is characterised by high positive loadings for Cattell 16PF Factors E and Q_1, negative loadings on Eysenck E and Cattell N.

The multivariate data set collected is too complex for meaningful relationships to be easily identified by considering all of the original variables. Principal components analysis allowed the important dimensions of body image and of personality to be identified; significant correlations could then be meaningfully interpreted.

The measurement of postural body image by both the SEA and the Abacus discriminated between the groups by the range of responses observed, but precision measurement was not obtained because of the inbuilt limitations of both devices for measuring body image. All the subjects in this study experienced great difficulty when using the Slade Russell Size Estimation Apparatus, estimating their body widths when the lights were "ascending" (In). This was possibly due to the fact that subjects have greater difficulty perceiving their body widths when the lights are moving from near peripheral vision than when they can see both lights throughout the trial, indicating a perceptual inability to orientate oneself when knowledge of the body is lacking or incorrect, such as may occur in a dark room.

The results of this study have suggested that subjects can over-estimate on one body width but can accurately estimate on other body parts. This would confirm that awareness of postural body image is segmented and not an "all or nothing" concept as some studies have suggested.

This study has shown that not only is the concept of postural body image multi-dimensional, but that within one dimension, such as the postural body image, separate components can be identified and examined. In addition to the previously identified accuracy component, two other elements in the postural body image have been postulated from these results; the part/whole quality of perception and the articulated/inarticulate style of body perception. These are consistent with the findings of Kessler (1978). The instrumentation used to measure the body image domain would need to have a more precise method of measuring body image. Both the SEA and the

Abacus demand a perceptual style with which subjects are not familiar and which is beyond their experiential knowledge, but the correct procedures were followed in order to reinforce the findings.

SECTION 6

CONCLUSIONS

SECTION 6

CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

1. Significant differences occurred between the two groups on weight, percentage body fat and the Ismail Fitness Score following the conditioning programme.
2. Significant differences occurred between the two groups on the Endomorphy component of the Heath-Carter Somatotype following the exercising programme.
3. Significant differences occurred on the Cattell Sixteen Personality Questionnaire Factor Q_4 (phlegmatic and composed vs. tense and excitable) between the non-exercising group and the exercising group.
4. No significant differences occurred on the personality factors as measured by the Eysenck Personality Inventory, but the exercising group lowered their score on the neuroticism factor.
5. No significant differences occurred between the groups on the body image domain as measured by the SEA and the Abacus, but women who participated in the conditioning programme were more accurate in their estimation of body widths and their range of responses was smaller than the non-exercising group.
6. Two important relationships were identified between the personality domain and body image domain.

6.2. Recommendations

The findings and conclusions of this study would seem to suggest that a person's perception of her body weight is influenced through the sensations which are communicated through her perception of her body shape. The women in this study who participated in the conditioning programme developed a highly articulate concept of body image which was clearly demonstrated by their sharpened perception of their "new" body shape. The active subjects at their post-programme evaluation indicated that by achieving a lower group score on the Eysenck neuroticism factor scale there was a demonstrable link with body image and the personality domain. This could be explained by the fact that the active group had become more secure, confident and socially adjusted because of their satisfaction with their "fitter" and "leaner" body shape. The premise to be drawn from this study is that although many of these links were not statistically significant, there was a tendency for the group of women who had participated in the conditioning programme to clearly demonstrate a sharp increase in global self-esteem. If the findings of this study are to be noted then they should be viewed to construct a radical re-think of the teaching of physical education in English secondary schools.

The basic concept of school is that of a special institution created and maintained by society in order to transmit aspects of its culture by means of purposeful teaching and learning to the next generation. P.J. Arnold, in his book "Education Movement and the Curriculum", states:-

> "The case for schooling rests on the broad argument that there are certain things we want children to acquire, or be provided with, which cannot be as well provided for at home or by the general social environment."

With this statement in mind, the unique justification for the inclusion of physical education in the school curriculum could never be in doubt. Through the medium of physical education children in the present day should be prepared for the wholesome use of leisure. Physical education should be defined as the curriculum subject which allows children to acquire physical skills through whole bodied physically demanding acitivites and allows the experiences of movement which in turn can complete the whole person. A thumbnail sketch of the teaching of physical education over the past thirty years would suggest that there have been few radical changes in the English secondary school's physical education curriculum.

The main thematic spine of the physical education programme has been the traditional competitive games, swimming, athletics and some form of gymnastics. There has been some tinkering around the edges with individual lifeskill activities of badminton, squash and, in authorities that could afford to send children away, outdoor activities. In the past five years many schools have taken "on board" physiological components of health and fitness. This intervention of fitness into the school curriculum has been largely motivated by the Health Education Authority's project directed by Len Almond at Loughborough University. Many new curriculum units have been devised based on an individual child's response to habitual vigorous physical activity. The physical education teacher

has, from 1988, been able to use the manual "Exercise Challenge" by Sonia McGeorge which has demonstrated unequivocally to secure the commitment of children to participating in regular physical activity in order to maximise their fitness levels to enhance their physiological health status. Many teachers have attended courses and "Baker" days in order to obtain knowledge regarding the primary causes of heart disease and how to modify cardio- vascular risk factors. Heart rate target zones, duration, frequency of exercise and levels of cholesterol are now the "buzz words" in physical education changing rooms. The inclusion of these health related fitness componenents into the school's physical education curriculum has tended to deflect what has been, for many decades, the primary focus of physical education, that is the teaching of sport and games.

While the teaching of sports and games may have been a worthy goal, many surveys of adults over the past ten years on the reasons why they participate in regular exercise have indicated that the two most clearly stated reasons have been:-

1) the desire to prevent heart attack

2) to lose weight.

The inclusion of health related components are in keeping with teaching principles of health prescription and the physiological effects, both acute and chronic, of regular vigorous physical activity.

This physiological perceptive of physical education has now become the most important reason for the functional teaching of the subject. The efficacy of this teaching programme through the medium of propositional knowledge presented in a discursive manner can

increase a child's physical competancy. The capacity of vigorous physical activity to provide both physiological and psychological benefits to participants would seem to be the next logical stage in the present curriculum development for the radical appraisal of the inclusion of "movement studies" in the National Curriculum.

Although the psychological benefits of exercise have not been as well documented, it is known that exercise develops a sense of "well being" or self esteem. The normal psychological research into exercise has been to investigate the process of health related behaviour. It is evident that a child's early interaction with the environment establishes the basic foundation of his self esteem. Fox, Corbin and Couldry (1985) have suggested:-

> "what we feel about our physical abilities by the time we leave school has a lot to do with whether or not we are attracted to physical activity during adulthood."

Gordon (1976) would suggest that there is a lack of congruity to establish a relationship between physical fitness and global self esteem across all people. He states that

> "It cannot be over-stressed that there is no single self concept held by any person."

The above statement would seem to suggest that the existence of a unifying global self concept across all people is a fallacy. On the other hand, through the vehicle of physical education, a child's cognitive awareness and perceptions of his/her body could be enhanced by arranging:-

1) positive feedback on all actions
2) success experiences
3) good counselling.

The good teacher of physical education should use his subject as an effective modality in the enhancement of a child's self esteem. The health benefits associated with habitual exercise are well documented in terms of biological health (Falls, Baylor and Dishman, 1980; Simons-Morton et al., 1987) but it has been shown that adult participation in many therapeutic exercise programmes typically experience a drop-out rate in excess of 50% during the first six months of involvement (Dishman, 1986). This would suggest that although the ostensible motive for involvement in an exercise programme may be health and fitness, there must be other therapeutic reasons to be pointed out to the participant for a lifetime commitment to habitual exercise. Although the teacher of physical education may consider that health enhancement and disease prevention may be of primary consideration, a more holistic view of exercise should be considered.

A new proposal for the teaching of physical education would be from an exercise psychological viewpoint which should focus on increasing a child's global self esteem and to increase his physical competancy. The teacher of physical education has the perfect scenario to improve the child's awareness of his self esteem and through involvement in physical exercise, lead to a growth in self esteem. The way to facilitate these gains would be to utilse a psychological model that would interpret, for the child:-

1) fitness gains

2) success experiences

3) personal growth in body competancy.

An individual child should be set achievable demonstrable goals

instead of being presented with gold standards which are "set in stone". The singling out of the self esteem for particular attention is not because of the widespread interest it has traditionally engendered, but because according to Gruber (1986) it appears to play a dual role that has potential impact on the exercise and fitness equation. Wylie (1979) has suggested that self esteem is associated with desirable human mental states and qualities which has led many educators to promote it as a primary objective in the curriculum, whilst Campbell (1984) has elevated the maintenance of self esteem to the heady status of the First Law of Human Behaviour:-

> "This law suggests that beyond essential physiological demands such as eating and sleeping, much of our behaviour, whether conscious or not, is directed toward maximising our chances of feeling good about ourselves."

Self esteem should be regarded as an important element of motivation and could directly be the prime reason for children's positive self perception and may in turn affect a child's persistence in physical activity. As Fox (1988), a leading proponent of the psychological effects of vigorous exercise, would suggest:-

> " The improvement of fitness related abilities would seem to provide potential targets for the achievement or competance motive and these may be reciprocally tied to the enhancement of self esteem."

It has been considered for many years by psychologists that the assessment of a child's self esteem could be achieved by totalling scores from a questionnaire which covered a vast spectrum of life

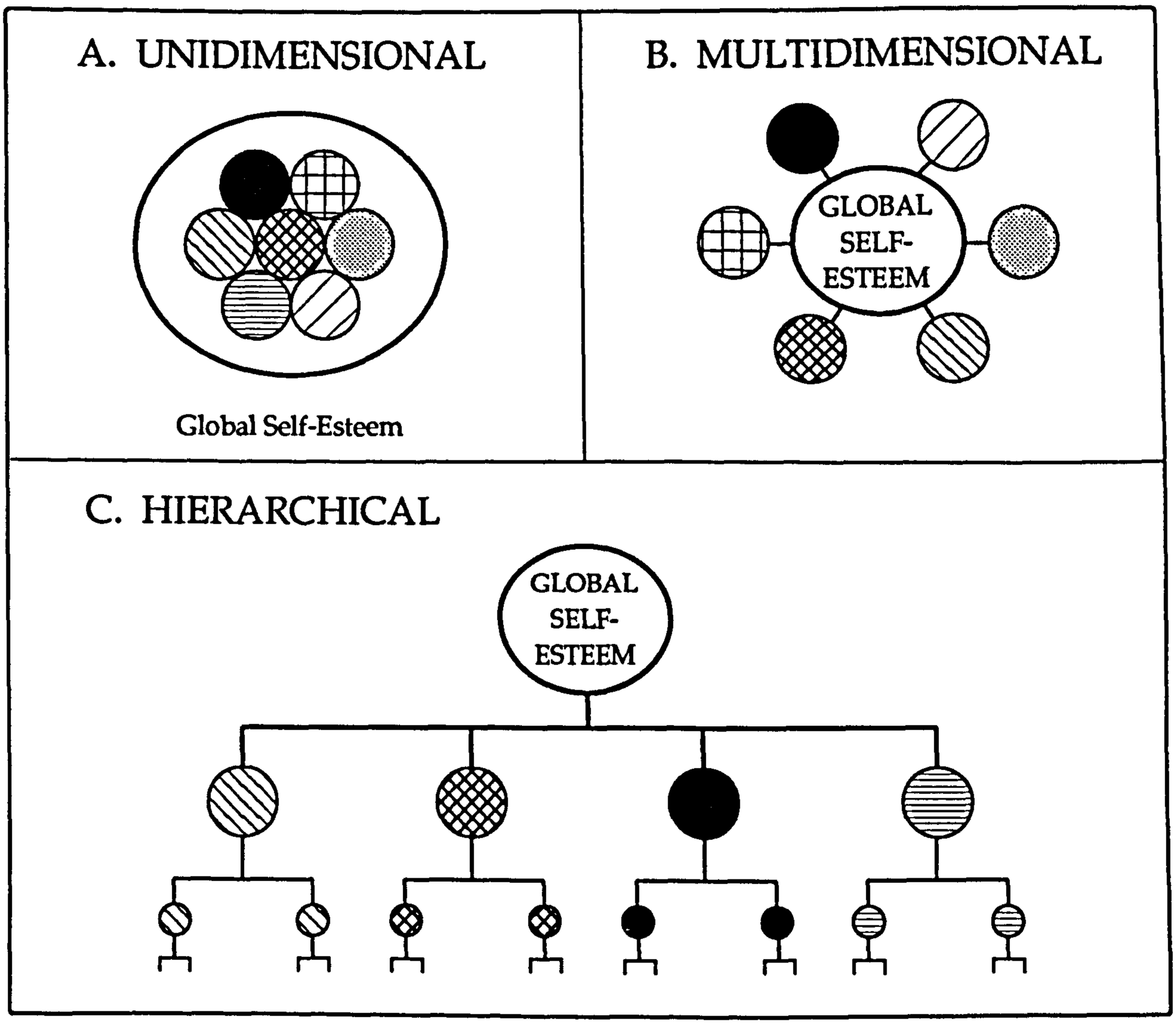


Figure 25 Models of self-esteem

activities. This was a unidimensional approach, as illustrated in Figure 25a Models of Self Esteem. This has been shown to be an erroneous concept, for both children and adults demonstrate a different feeling to the varied aspects of their lives.

At the University of Denver, Harter (1985) has created a Self Perception Profile which has suggested that self esteem is multi-dimensional (Figure 25b). Harter has also found that children from as young as the age of seven years

> "have clearly differentiated perceptions of adequacy in school work, friendships, behavioural conduct and of particular interest to physical education, sports competence and physical appearance".

(Fox, 1988).

This profile approach provides a purposeful summary of a child's perception and allows independent assessment in different domains. This should allow interested teachers of physical education to assess children's true feelings towards physical activities, and help to tease out a child's perception of his or her physical competancy.

By the use of this self profile technique, many researchers have found that self esteem has a hierarchial structure. The proponents of this model would suggest that we have a global self esteem at the apex which could be constructed to be the outcome of our evaluative perceptions in numerous domains of our lives.

In the past two years, Fox has proposed a model of the Different Levels of Physical Self Perception (Figure 25a) which summarises his research in the physical domain of self esteem. It would seem to demonstrate that aspects of the physical self such as

body image, physical ability, movement, confidence, sports competance and fitness are so inter-related that it would be fallacious to study them individually. To investigate these inter-related domains, Fox (1988) has constructed The Physical Self Perception Profile (PSPP) which consists of five subscales to assess perceptions of bodily attractiveness, sports compentance, physical condition, physical strength and general physical esteem. This profile has been developed using a college student population in the United States (Figure 26). At the present time a British Profile is being validated in England by Fox and Ashford and should provide an insight into English secondary school children's physical self perceptions in early September 1990. But as Harter has clearly demonstrated in her research, many adolescents are keen to maximise their self esteem by attaching great importance to those areas which provide a sense of accomplishment, whilst on the "downside" they quickly discount the importance of those domains in which they consistently experience a lack of competance and failure.

The most important concept that needs to be applied to their teaching by physical educators is that children need to feel good about their physical selves which should have the "knock-on" effect of improving their global self esteem. Fox would suggest that:-

> "the main components of the physical self appear to result from sports competance, physical appearance and fitness factors such as strength and cardiovascular conditioning."

For children to be encouraged to develop and nurture a sense of physical competance, the physical education programme needs to be

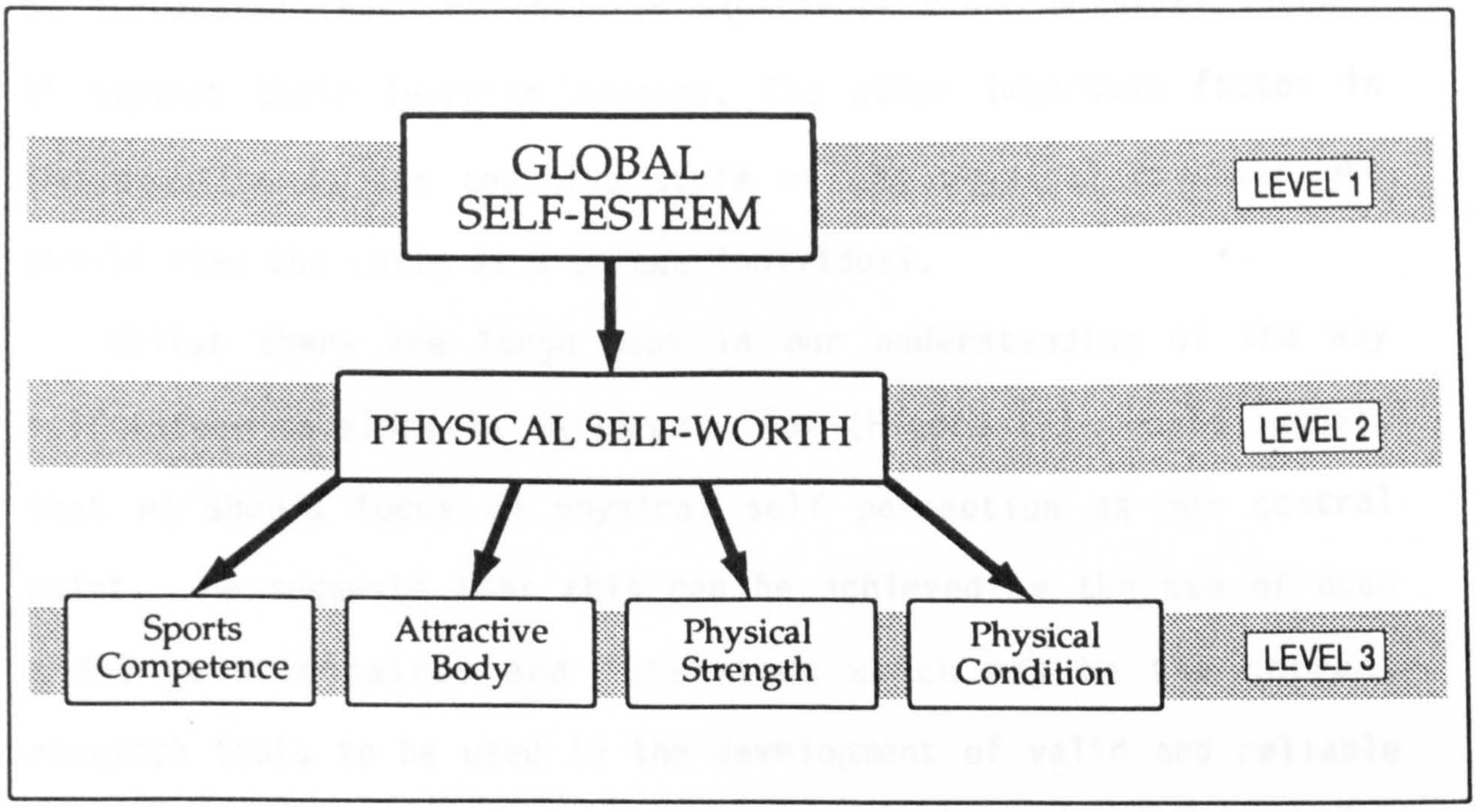


Figure 26 Content and structure of the physical self

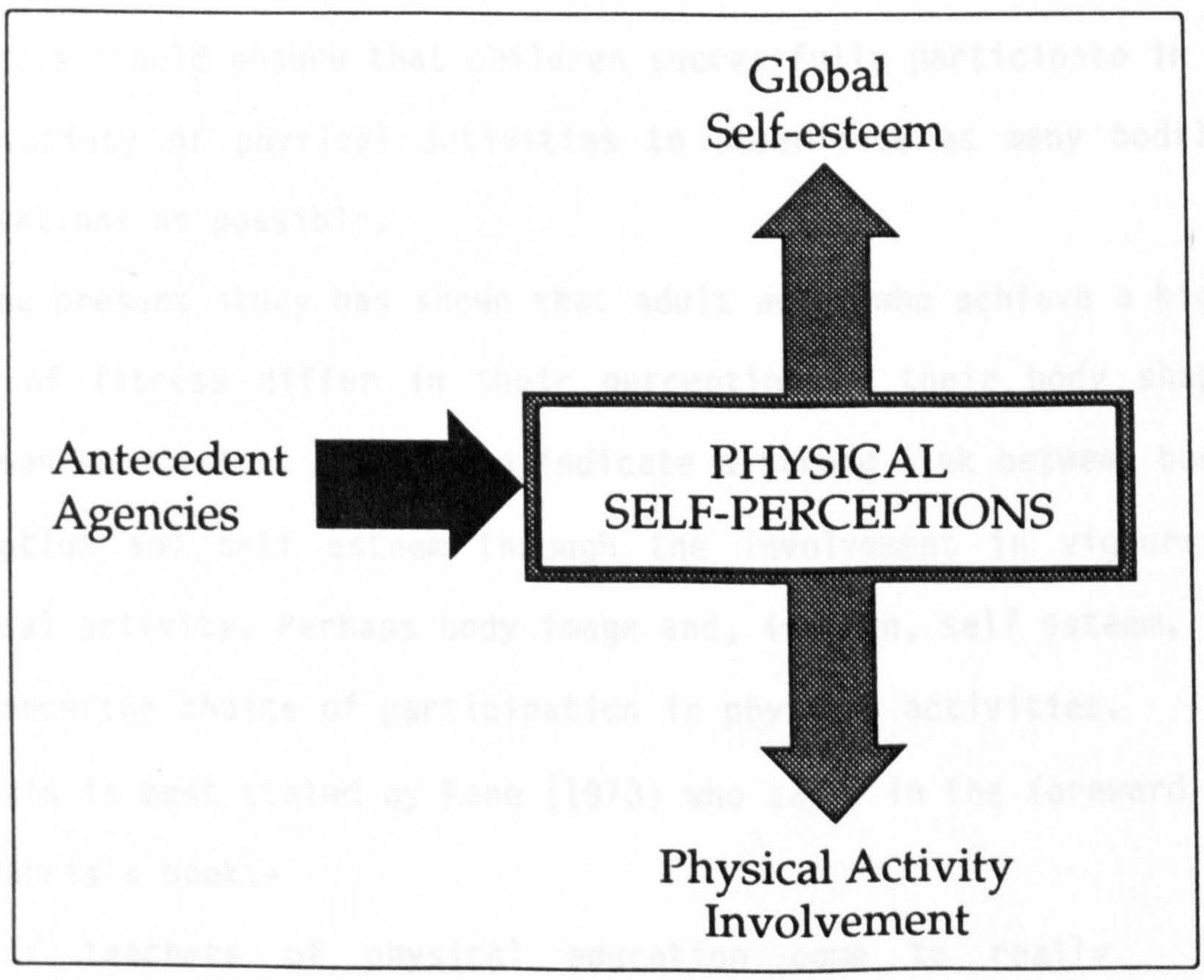


Figure 27 A physical self-perception research model

so structured that the children experience clear physical success throughout their learning process. The other important factor in the equation is the teaching style of the physical educator who should view the child as a unique individual.

Whilst there are large gaps in our understanding of the way self esteem develops in children, Fox (Figure 27) would suggest that we should focus on physical self perception as our central point. He suggests that this can be achieved by the use of open ended questionnaires and interviews which may be the correct research tools to be used in the development of valid and reliable self perception profile.

If education is concerned with the enlargement and enrichment of awareness then the learning of physical skills has an important place in the development of a person. My own view is that physical educators should ensure that children successfully participate in a wide variety of physical activities to experience as many bodily orientations as possible.

The present study has shown that adult women who achieve a high level of fitness differ in their perception of their body shape from non-exercisers. This would indicate a strong link between body perception and self esteem through the involvement in vigourous physical activity. Perhaps body image and, in turn, self esteem, do influence the choice of participation in physical activities.

This is best stated by Kane (1973) who says, in the foreward to D H Harris's book:-

> "If teachers of physical education come to really appreciate the ways in which the total personality

development of their students may be influenced during the course of bodily activity, then the momentum and direction of physical education in schools may change in many ways."

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APPENDIX

OCCUPATIONS OF EXERCISERS AND NON-EXERCISERS TAKING PART IN THE STUDY

OCCUPATIONS	NON-EXERCISERS	EXERCISERS
Bank Clerk	0	2
Book Keeper	1	0
Civil Servant	0	3
Clerk	4	5
Computer Programmer	1	0
Engineering Tracer	0	1
Graphic Designer	0	1
House Wife	1	0
Insurance Clerk	0	1
Journalist	1	0
Medical Secretary	1	0
Public Relations Officer	0	1
Punch Card Operator	0	1
Secretary	6	3
Senior Housing Assistant	0	1
Sewing Machinist	0	1
Shop Assistant	0	2
Shorthand Typist	2	1
Student	5	0
Teacher	2	1
Telephone Operator	0	1
Undergraduate	1	0
TOTAL	25	25