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THE INVESTIGATION OF EXERCISE AS AN ADJUNCT TO THE  
TREATMENT AND REHABILITATION OF THE PROBLEM DRINKER

by

MARIE ELIZABETH DONAGHY

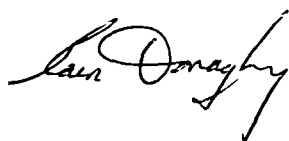
BA (Hons)., M.C.S.P.

This thesis is submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy in the Institute of Biomedical and Life Sciences, Faculty of Medicine, Glasgow University.

## Declaration

I declare that this thesis was composed by myself and that all data were collected and analysed by myself. This study builds on earlier work undertaken by the author in collaboration with Dr George Ralston and Dr Nanette Mutrie during the period 1988-1990.

Signature



M.E. Donaghy

Date

27 June 1997

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## ABSTRACT

The effects of undertaking a three week supervised exercise programme followed by a twelve week home based exercise programme, were investigated with adults in an abstinence treatment programme within four alcohol problem clinics. A randomised experimental design was used with physiological and psychological variables being measured at baseline, on entry to the programme, at 1 month, following the intervention programme and then at time points from baseline at 2 months and 5 months. Recruitment to the study of 165 subjects exceeded expectation. Of these 117 completed the first stage with 61 in the exercise group (n=46 male : n= 15 female) and 56 in the placebo control group ( n= 43 male n=13 female)

At 1 month only the exercise group showed improvement in the physiological parameters of fitness by estimated  $\text{VO}_2$  max. ( $p < .0001$ ) and strength ( $p < .008$ ), and psychological improvements in physical self worth ( $p < .02$ ), self perceptions of condition ( $p < .007$ ) and strength ( $p < .003$ ). There was no difference between the groups in flexibility, body weight, or resting pulse, or in the psychological parameters of anxiety or depression. At 2 months the exercise group were more physically active ( $p < .02$ ) physiologically fitter ( $p < .0001$ ) had improved strength ( $p < .0005$ ) and still maintained psychological improvements in self perceptions of condition ( $p < .001$ ) and strength ( $p < .002$ ). The Carbohydrate Deficient Transferrin (CDT) blood test revealed no differences between groups at either two months or five months, with the test indicating that 31% were in relapse at two months and 44% at five months. Only fitness ( $p < .003$ ) differed between the two groups at five months (n= 22 exercise group and n = 21 in control group). However the statistical power of the analyses was reduced since many subjects who completed the intervention programme had now dropped-out from the study (n=39 exercise group; n=35 control group).

The findings of this study indicate that the inclusion of a three week programme of exercise in an abstinence rehabilitation programme improves fitness, strength, physical activity and physical self-perceptions and that these improvements are maintained for a further month by undertaking a home based exercise programme. At five months however, only improved fitness is maintained. There is no evidence that exercise can be linked to maintaining abstinence levels. Under reporting of drinking behaviour was high. At two months 27% and at 5 months 35% of those identified by the CDT blood test as drinking, at levels associated with relapse, self reported abstinence or low levels of alcohol intake. These findings have clinical relevance to physiotherapists and other health care professionals, as they indicate that problem drinkers have low aerobic fitness and low self perceptions. Inclusion of a three week programme designed to improve fitness and strength, followed by a home based programme, may be beneficial in improving these parameters with the possibility of increasing physical activity.

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## **CHAPTER 1**

### **INTRODUCTION**

#### **1.1 HISTORICAL CONTEXT**

Alcohol has been prepared by different societies throughout the world for thousands of years (Ritson, 1994). It is the most commonly taken psychoactive drug and has been used as a tranquilliser, a stimulant, an anaesthetic, a medicine, a religious symbol, a food, a fuel and a transition from work to play (Saunders, 1985). The benefits of alcohol in increasing enjoyment and well being within societies along with the problems associated with excessive consumption, can be observed in the earliest writings of scriptures, poems, and plays.

Health problems related to alcohol consumption, came to the attention of medicine in the eighteenth century. The pioneering work undertaken by Thomas Trotter and submitted to Edinburgh University as his MD thesis in 1788, raised awareness of the addictive properties of alcohol and the complexity of medical and social problems associated with excessive consumption. His subsequent essay on the topic, originally published in 1804

and reprinted in the last decade as a 1988 Routledge edition, provides an important insight into the way alcohol was perceived at this time. The other early activist in the field was Dr Benjamin Rush, he published his work debating the addictive properties of alcohol three years earlier in 1785. This academic writing, stated that alcohol was causally linked to cravings and helpless, addictive behaviour (Heather & Robertson, 1989). The writing was both observational and moralising and included suggestions for the control of alcohol through heavier taxes and fewer taverns. Unlike Trotter, Rush did not advocate abstinence, believing that certain alcoholic beverages were less toxic and less addictive than others. The work of both these scientists informed the ideology of the temperance movement, with the problem drinker being seen as the victim of addiction. The disease concept of addiction was thus given recognition and acceptability, the treatment that followed related to either moderation or abstinence. These two differing concepts of treatment are still current today, with some treatment approaches including controlled drinking and others advocating only abstinence.

Early Customs and Excise records indicate that our ancestors consumed large amounts of alcohol (Royal College of Physicians, 1991), however death and disease due to alcohol may have been less obvious. There were many other diseases around and life expectancy was often violent and short (Royal College of Physicians, 1991). Although medical problems were not highlighted in the sixteenth and seventeenth century drunkenness was recognised as a social disorder and a punishable offence. Queen Elizabeth I introduced the first major licensing acts giving local justices the power to control the sale of alcohol (Royal College of Physicians, 1991). The introduction of taxation by King John in 1643 on wine imports and beer duties produced a useful source of revenue for his and successive governments. This necessitated records to be kept by Customs and Excise, providing records of alcohol production over the last three centuries. Information on consumption and changing patterns of drinking have been collated and published since this time (Royal College of Physicians, 1991).

## 1.2 ALCOHOL RELATED HARM

The consumption of alcohol in the United Kingdom over the last three hundred years has declined, from twenty litres per head of population per year in 1690, to nine litres per head of population per year in 1991 (Ritson, 1994). In comparison to other European and Scandinavian countries only Sweden has lower consumption, at seven litres per head of population. North American consumption per litre per head is similar to the United Kingdom, with the Australian higher at nearly eleven litres per head (Ritson, 1994). However favourable these statistics may appear, alcohol consumption in the United Kingdom leads to health problems, contributing to mortality and morbidity, and it is expensive in regard to the utilisation of health and social service resources (Heather and Robertson, 1989).

Alcohol related mortality is highest with regard to chronic liver disease, followed by increased risk of cancer of the larynx and oesophagus, cerebrovascular disease and injuries through accidents (Ritson, 1994). Morbidity includes the above diseases, and the following: respiratory disease; neurological deficits; cognitive impairment including dementia; circulatory problems; pancreatitis, ulcers and digestive problems (Edwards, 1982). Poor physical fitness has been reported among problem drinkers (Palmer et al., 1988). Along with evidence of negative effects of alcohol on skeletal muscle (Preedy & Peters, 1990), loss of bone mass and associated increased incidence of fractures (Peris et al., 1992; Rico, 1990).

Alcohol related harm is also associated with common psychopathologies such as depression (Davidson & Ritson, 1993), and anxiety (Stockwell & Bolderston, 1987). Other psychiatric problems described by Edwards, (1982) include: hallucinations; paranoid delusions; and pathological jealousy. In addition to this harmful drinking can lead to functional disorders such as sexual dysfunction and loss of memory (Madden, 1994). Other psychological disturbances affecting problem drinkers are alienated self

image, lowered self esteem (McMahon & Davidson, 1986), and lowered self efficacy (Heller & Krauss, 1991).

### **1.3 DEMAND ON HEALTH RESOURCES**

Not surprisingly several studies have shown a relationship between heavy alcohol consumption and use of hospital services (Royal College of Physicians, 1987). Accident and emergency attendance's after midnight are frequently alcohol related, accounting for 46% of attendees in one study (Backhouse et al., 1986) and 39% in another (Sharkey et al., 1996). This relationship has also been found in other studies (Walsh & MacLeod, 1980; Yates et al., 1986). Buchan et al. (1983) reported that patients with alcohol problems consult their general practitioners twice as often as the average patient. Many studies of general medical wards suggest that between 12% and 27% of males admitted to these wards, demonstrate features indicative of alcohol problems (Jarman & Kellett, 1979; Lloyd et al., 1986; Taylor et al., 1986; Lockhart et al., 1986; Moore et al., 1989).

Although many of the studies can be criticised in their methodology, for example: failing to clarify their interpretation of problem drinking; lack of control group; no clarity in regard to causal relationship between illness and drinking; the findings of existing studies are consistent with regard to the loading on the health service.

Patients abusing alcohol account for a substantial proportion of those seen in emergency and liaison Psychiatry (Chick and Cantwell, 1994). The psychiatric complications associated with alcohol abuse may require frequent admissions and long term support within the services provided (Heather & Robertson, 1989).



## 1.4 COST TO SOCIETY

The cost to society of alcohol misuse has been estimated to be in the region of two billion pounds per year (Maynard, 1989 cited in Unnithan et al., 1994). The cost to industry alone through absenteeism and lost productivity has been estimated at 770 million pounds a year (Paton, 1994). However this enormous cost to the government has to be considered alongside the revenue obtained from duty and exports, which is estimated to be 7 billion pounds a year (Paton, 1994). The industry is a major employer with an estimated 125,000 people working in the drinks industry (Paton, 1994).

## 1.5 DEFINING PROBLEM DRINKING

There is no perfect definition for alcoholism, but an individual who experiences multiple serious life problems as a result of prolonged and heavy drinking is identified as a problem drinker or alcoholic (Royal College of Physicians, 1987). For most people alcoholism is perhaps synonymous with severe alcohol dependence or the disease of 'alcoholism' (Royal College of Psychiatrists, 1986). The latter term was introduced by Magnus Huss in 1865 and over time has become wide ranging and all embracing in its definition, covering a diverse range of alcohol problems. Since its inception the concept of alcoholism has been the subject of negative stereotypes (Chick & Cantwell, 1994) and for this reason the term problem drinking is frequently used. For the purpose of this thesis the term problem drinking will be used in the general sense, to focus on the wide ranging problems that the repetitive use of alcohol can cause to an individual, society or both.

The problem drinker usually consumes alcohol daily, at levels recognised to be hazardous or dangerous to health. Males drinking in excess of 49 units of alcohol a week are defined as heavy drinkers and are likely to endanger their health (Paton, 1994). For females the level of hazardous drinking is lower at 40 units per week. A unit is

defined as being equivalent to one half pint of beer or a single measure of spirit (8g of ethanol alcohol per unit). Problem drinkers are usually drinking in excess of these amounts and are recognised to be in relapse drinking when consuming 56 units a week or more (Chick, 1996). Despite repeated efforts to control intake, the problem drinker is usually unable to stop for long periods of time. The drinking pattern may continue for many years and is often accompanied by evidence of impairment in health, and in social and occupational functioning. There may be increased tolerance to alcohol and evidence of withdrawal phenomena, nausea and vomiting, tremors and shaking, and hallucinations, when the individual stops drinking (American Psychiatric Association, 1992).

The term primary alcoholism may be used when the problem drinker has had no major pre-existing psychiatric illness (Schuckit, 1985). Individuals who develop alcohol related problems after manifesting evidence of bipolar or anti-social personality disorder may be termed secondary alcoholics (Schuckit, 1985). The distinction has been linked to clinical implications for treatment, with data from previous longitudinal studies showing that primary and secondary alcoholics demonstrating significantly different outcomes at one year post intervention (Schuckit, 1985).

The International Classification of Diseases (ICD-10; World Health Organisation, 1992) and the Diagnostic and Statistical Manual of Mental Disorders DSM-IV (American Psychiatric Association, 1994) are the two most widely accepted international communications on the classification of mental health problems. Alcohol abuse disorders are similarly defined in these manuals and follow the earlier recommendation of epidemiologists to assess the amount of alcohol consumed separately from the social, mental and physical problems caused by drinking. Likewise dependence along with attitudes and actual behaviours associated with relapse are to be assessed separately (Chick & Cantwell, 1994).

The evidence to suggest that severity of dependence is linked to poorer clinical outcome is weak (Shuckit et al., 1985). To date the best predictors of clinical outcome have been measures of psychiatric symptoms, social problems and personality type (Institute of Medicine, 1990; Chick, 1993).

## **1.6 NATURE AND EXTENT OF THE PROBLEM.**

In the United Kingdom alcohol abuse is responsible for 25,000 - 40,000 deaths per year. Fifty-five million or 65% of the population consume alcohol regularly (Royal College of General Practitioners, 1986). In the last fifty years the amount of alcohol consumed per capita and number of alcohol related deaths has doubled. The Royal College of Physicians (1987) have called it the 'great and growing evil'. The amount of alcohol consumed each year is calculated from production figures, imports and exports. This may be a conservative indicator of actual consumption, it does not take account of home production, or alcohol brought into the country by returning holidaymakers, or illicit imports.

Statistics on alcohol misuse have been criticised for being less reliable than consumption figures because of lack of agreement over definitions and difficulties in establishing harmful levels of intake (Paton, 1994). Data is gathered from household surveys and on specially commissioned drinking surveys. Surveys have repeatedly indicated that in the United Kingdom more money is spent on alcohol than any other commodity (Paton, 1994) and it is estimated that 90% of the population are drinkers. Of this population the number of habitually heavy drinkers is estimated at about four million with one-fifth of them problem drinkers (Paton, 1994).

In the last twenty five years there have been a number of carefully conducted surveys of drinking habits within the United Kingdom (Goddard, 1991). These surveys give an

indication of groups at risk and prevalence of alcohol related problems in the population and enable changes arising from health initiatives or changes in legislation to be monitored. The surveys however are limited in that the reported consumption by the population is always below the known consumption levels by the trade figures (Ritson, 1994). There is evidence to suggest that the heaviest drinkers are the most unreliable to gain information from. This is frequently due to difficulty in accessing them for surveys, reasons include less willing to participate, or no settled accommodation (Ritson, 1994).

In 1986 it was estimated that 24% of men and 7% of women in Scotland drink above the safe limits with alcohol contributing to 3,000 Scots deaths every year (Scotland's Health, 1992). Safe levels of drinking have been suggested as 2-3 units a day for females and 3-4 units a day for males (Department of Health, 1995).

A recently published survey undertaken with 7,722 schoolchildren in the UK. indicates that the problem of drinking above these safe limits is growing among young teenagers. Almost all of those surveyed, aged 15 years or less, had regularly consumed alcohol in the past thirty days. Of those surveyed 50% were consuming five or more drinks one after the other on a regular basis (McC Millar & Plant, 1996). This change in drinking pattern is of concern. Already the highest rates of drinking occur in the 18 - 24 age group (Health of the Nation, 1992), with overall frequency of drinking among 15 - 16 year olds increasing (Goddard, 1996). Early age onset of regular drinking is associated with heavy consumption and alcohol- related problems in later life (Paton, 1994).

## **1.7 GOVERNMENT HEALTH POLICY**

The Government highlighted the risks associated with heavy consumption of alcohol in the Health of the Nation document (1992), prioritising the area of alcohol related mortality and morbidity with a view to reducing alcohol consumption . Similar priorities were identified, and targets for reduction set, in the Scottish Home and Health policy

document Scotland's Health (1992). Within both these documents the need for all health related professionals to be aware of the problems associated with alcohol abuse is highlighted. It is emphasised that all health care professionals have the responsibility for supporting change, towards a reduction in alcohol consumption, among patients drinking at levels likely to endanger their health.

## **1.8 TREATMENT OF ALCOHOL MISUSE**

It became evident in the 1980's, from the growing body of research at that time, that the treatment approaches for problem drinking were not successful (Polich et al., 1980). The Rand report (Polich et al., 1980) indicated that 93% of problem drinkers had returned to drinking within four years of receiving treatment. The evidence also suggested that intensive inpatient treatment was no more successful than shorter programmes (Saunders, 1985; Chick et al., 1988).

It is currently accepted that problem drinking is a multifactorial problem indicating that a range of treatments should be made available to match clients' individual needs. This has recently been reflected in rehabilitation programmes, with a move away from the traditional approach encompassing one model of care, to a newer "cafeteria" approach offering a range of options for the patient (Sanchez-Craig, 1990). There is a need to provide treatment for both acute care needs and chronic care needs of the problem drinker. Three major stages have been identified in the management of individuals and their families. Stage one: detoxification; emergency treatment and screening. Stage two: rehabilitation, evaluation and assessment; primary care and extended care. Stage three: maintenance aftercare; relapse prevention; and domiciliary care (Institute of Medicine, 1990).

The concepts and models associated with addictions and problem drinking need to be explored to enable an understanding of the way that theory has informed approaches to treatment.

### **1.9 CONCEPTS AND MODELS OF ALCOHOL ADDICTION**

Brickman et al., (1982) identified four models namely the moral, enlightenment, medical, and compensatory, as being useful explanations with regard to both aetiology of the problem and its treatment. The oldest explanation is associated with the moral model with problem drinking seen to be a result of lack of 'will power' and 'moral fibre'. The treatment requires the individual to see these self weaknesses and by self discipline bring about desired change. This model is not considered a useful model in relation to treatment today as it is seen to be covertly informed by religious beliefs and moralistic judgements.

The enlightenment model is an extension of the previous model. Recovery is dependent not only on the individual recognising his problem but allowing a mentor to intervene and take responsibility for the recovery process. The philosophy of Alcoholics Anonymous with its mentoring approach can be said to be a model of the enlightenment approach (Brickman et al., 1982). This model, like the previous one, is not considered a particularly useful model to inform treatment. Suggesting that dependence and support from another person is essential for recovery.

The medical model, sometimes referred to as the 'disease concept' views the problem drinker as a helpless agent. The illness is viewed as having a genetic predisposition with familial environmental factors also being implicated. The treatment is based on intervention programmes which incorporate the twelve steps of Alcoholics Anonymous the most influential of these being the Minnesota model (Cantwell and Chick, 1994). The aim is to control symptoms through abstinence (Heather & Robertson, 1989). To assist

in achieving this deterrent drugs such as disulfiram may sometimes be used, which produce a marked physiological reaction if alcohol is taken, this lasts for over forty-eight hours. This model is a current approach that is popular in United States of America and in private clinics within the UK. A cure awaits further scientific developments in genetics or pharmacology.

The fourth model proposed by Brickman et al. (1982) is the compensatory model. This model sees the individuals' drinking, as an overlearned coping response to stress. This model is based on theories of social learning. In contrast to the medical model the emphasis is on the individual to compensate for the problems associated with drinking. This requires the individual to take responsibility for recovery by changing behaviour. The medical or 'disease' model and the compensatory model are the two models that underpin current treatment approaches in the UK. for that reason they will be discussed in greater detail in the literature review.

The compensatory model has informed recent developments in treatment which include the 'cafeteria' approach. The treatment includes goal choice options for clients and incorporates cognitive and behavioural techniques to improve coping abilities. Within this model the concept of self efficacy is seen as important with regard to coping. Bandura (1977) described this concept as the measure of a person's confidence that a chosen behaviour can be successfully performed. In regard to drinking this suggests that a person with high self efficacy will, in a stressful situation, choose relaxation, physical exercise, self assertiveness or the resources of a support agency, as a chosen behaviour (coping strategy), rather than return to drinking (an avoidance strategy). This model is embraced by Marlett & Gordon (1985) and their concept of relapse prevention. They propose that recovery is dependent on learning coping skills and alternative behaviours and employing them to cope with maintaining change and dealing with relapse if it occurs. Self efficacy develops through practising these skills and is central to recovery.

The endorphin compensation hypothesis can be considered as psychophysiological support for this approach (McMahon & Jones, 1992). The work of Volpicelli (1987) indicates that endorphinergic activity is reduced during alcohol withdrawal and this is linked with craving for alcohol. His work with problem drinkers demonstrates that endorphin levels are also reduced when an individual feels helpless in a situation, leading to craving for alcohol. However when in a similar situation the individual feels more confident in coping, no such reduction in endorphins is evidenced, and abstinence is maintained.

### **1.10 THE ROLE OF EXERCISE WITHIN TREATMENT.**

The use of exercise as part of a rehabilitation programme for problem drinkers would seem intuitively to be an appropriate behaviour (coping strategy) for dealing with stress, improving mood, increasing self confidence and improving general health. There is some evidence to support the use of exercise with problem drinkers in a clinical setting. Work that has been undertaken with clinical populations of problem drinkers links exercise with the following: reduction in anxiety and depression (Frankel & Murphy, 1974; Palmer et al., 1988;) improved physical fitness (Gary & Guthrie, 1972; Tsukue & Shohoji, 1981; Sinyor et al., 1982;) improved self esteem (Gary & Guthrie, 1972) and improved abstinence (Sinyor et al., 1982). In addition research in a non-clinical population suggests that running in a regular programme can significantly reduce alcohol consumption among heavy social drinkers (Murphy et al., 1986). The anti-depressant effects associated with exercise have been linked to increased endorphin levels (Palmer et al., 1988) suggesting that exercise may be an appropriate alternative behaviour to employ as a coping strategy.

The limited research effort in this area is surprising in light of the findings reported from associated areas in exercise psychology and clinical psychopathology (Dishman, 1994)



where a growing body of evidence in relation to exercise mediated psychological changes has been established in the last twenty five years. These include: decreases in anxiety (Petruzello et al., 1991); decreases in depression, (North et al., 1990; Plante, 1993); and improved self concept (Collingwood & Willet, 1971; Folkins & Sime, 1981). The endorphin and mastery hypothesis have both been put forward as possible mechanisms to account for the feelings of well being, and reductions in anxiety and depression (Biddle & Mutrie, 1991).

The relationship between alcohol consumption and mood is complex with additional psychopathology common in both community and clinical populations (Davidson & Ritson, 1993). Depression is frequently found among problem drinkers (Hertz, et al., 1990) along with high levels of anxiety (Maser & Cloninger, 1990) and low self esteem (O'Leary & Chaney, 1978). The evidence to support the use of exercise with clinical populations for the treatment of common psychopathologies such as depression has been informed by the work of Martinsen et al (1985; 1989a) and Martinsen (1987; 1990).

The evidence from exercise psychology and clinical psychopathology suggests that exercise may be beneficial in the treatment of the problem drinker to enhance mood, improve self esteem and skills of mastery. This should be considered alongside the benefits to general health from participation in regular exercise. The Allied National Dunbar survey (1992) states that benefits include reduced risk of coronary heart disease, prevention of osteoporosis, reduced stress, increased stamina, enhanced mood and self esteem. Problem drinkers because of their poor health which includes muscle wasting, bone loss and poor fitness levels should be particularly targeted for exercise for these health benefits.

Edwards (1982) more than a decade ago brought this to the attention of programme planners in his text book on the treatment of problem drinkers. He states that attention

should be paid to physical health which often causes problems in the early stages of rehabilitation.

A feeling of rediscovered physical well being may be one of the prime rewards of sobriety, and work under this heading (physical health) should therefore entail not only dealing with ill-health, but efforts positively to enhance good health.

Edwards, 1982 p208.

### **1.11 EXERCISE PRESCRIPTION FOR PROBLEM DRINKERS**

In the UK, physiotherapists working in the clinical specialist area of psychiatry are using exercise as a treatment intervention for numerous mental health problems including alcohol addiction (Smeaton, 1995). The rationale for treatment is loosely based on research findings from other areas of exercise physiology and psychology. For example the effects of exercise on mood, with consideration given to the limited evidence in the alcohol studies cited above.

There is a gap at present in the literature relating to the type, intensity and duration of exercise that will be beneficial to problem drinkers. The research previously undertaken does not lead to a consensus of opinion regarding the intensity and duration of exercise necessary to be effective. The type of exercise selected may be very important in regard to adherence of the programme (Biddle & Mutrie, 1991) and is an important consideration in regard to choice in a "cafeteria" approach to treatment.

The potential psychological and physiological benefits of exercise for the rehabilitation of the problem drinker as previously indicated are numerous. However with many alcohol rehabilitation programmes currently of three or four weeks duration, the psychological and physiological benefits associated with this short timescale have yet to be fully explored. It is therefore important for the physiotherapist and the rehabilitation team to

have further scientific evidence that will inform the most appropriate programme of intervention.

### **1.12 NEED FOR GUIDELINES ON EXERCISE PRESCRIPTION FOR PROBLEM DRINKERS**

There is a need for clinical guidelines on the type intensity and duration of exercise for problem drinkers. However the experimental evidence of the benefits of an exercise programme as a therapeutic intervention with clinical populations of problem drinkers is at the moment not sufficiently well developed to allow categorical conclusions to be drawn. The methodological weaknesses associated with previous studies in the area combined with a lack of theoretical underpinning makes it impossible to produce an evidence based statement at this time.

### **1.13 NEED FOR RESEARCH**

This chapter has identified the nature and extent of excessive alcohol consumption in the UK. The risks to health and costs to health providers have been outlined. The theoretical underpinning and rationale for including exercise within alcohol rehabilitation programmes has been highlighted, along with the benefits of an exercise programme. There is a need for further research to determine the effectiveness of exercise as an intervention strategy, within the current treatment approaches being offered to problem drinkers.

### 1.14 STATEMENT OF AIMS

The aim of the study was to evaluate the short and long term effectiveness of an exercise programme as an adjunct to treatment with problem drinkers. Taking into account the current length of time of in-patient and out-patient treatment programmes, with answers being sought to the following questions:

- Does the inclusion of a three week exercise programme in an abstinence rehabilitation programme lower levels of anxiety and depression?
- Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme enhance levels of physical self-worth?
- Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme enhance patients' subjective experience of body image, condition, and strength;
- Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme, over and above improvements related withdrawal from alcohol, the physiological parameters of aerobic capacity, strength and flexibility?
- Can the effects of an exercise programme be linked to maintaining abstinence levels up to four months post discharge?
- Does participation in a three-week exercise programme followed by a twelve week home-based programme increase levels of physical activity during the four months post discharge period?

To enable these aims to be met a randomised controlled study was undertaken at several clinical sites specialising in the treatment of alcohol problems across Scotland. The data

gathered were analysed and the findings considered in relation to current management and treatment of problem drinkers. A report on the findings of this study was presented to the Health Services Research Committee (Scottish Home and Health Department) in 1996.

### **1.15 PLAN OF THESIS**

The second chapter of this thesis reviews in detail key aspects of the literature in relation to the following: causal links with addiction; treatment approaches based upon the medical and compensatory models of addiction; potential of exercise for this clinical group. The contribution from current research findings in the area are summarised along with the gaps in existing knowledge, and the aims of the research are reiterated. The third chapter defines the method and theoretical approach, giving an account of the considerations that informed the study and the justification for the design. Chapter four reports on the findings of the multi-site clinical study and contains detailed analysis of the data obtained. Chapter five contains a detailed synthesis of what was found and the relevance of the findings to current knowledge, treatment, future research and current physiotherapy practice. Chapter six presents the conclusions of the study.

## **CHAPTER 2**

### **LITERATURE REVIEW**

This chapter reviews the literature in three specific areas related to problem drinking. The first section discusses the research related to causal links. Within this section the evidence for genetic predisposition will be explored alongside the evidence that suggests that problem drinking is the result of a complexity of environmental influences acting upon individual characteristics. This is followed by a section which reviews the literature that informs current practice in treatment. The medical and compensatory models that inform current treatment will be discussed alongside evidence of outcomes from treatment. The third section contains a critical analysis of the literature on the use of exercise in the rehabilitation of problem drinkers, highlighting the potential benefits in current approaches to treatment.

#### **2.1 THE AETIOLOGY OF ALCOHOL ADDICTION**

The earliest nature versus nurture debates on the causes of alcohol were generated by the temperance movement (Levine, 1978). The view held indicated that the accessibility, availability, and social use of alcohol were the root of the problem. They also supported the disease perspective, seeing the problem drinker as a helpless victim. The growing body of research from the disciplines of genetics, social science and psychology (Sutton, 1987; Cook & Gurling, 1990; Pohorecky et al., 1991; Lazarus, 1993) indicate that problem drinking has a multifaceted aetiology. It would

also seem likely that for each problem drinker their addictive behaviour has arisen as the result of a different interaction of various aetiological factors (Cook, 1994). The various aetiological factors are presented in this chapter.

### **2.1.1 Familial links**

Family studies have shown a three to four fold increased risk in sons and daughters of alcoholics, without evidence of increased vulnerability to other psychiatric disorders (Cotton, 1979; Schuckit, 1986). This evidence however, does not allow the distinction between the impact of the environment to be separated from genetic predisposition. The study of twins and adoption studies are useful in disentangling genetic and environmental factors.

#### **2.1.1.1 Twin studies**

Twin studies have consistently shown greater monozygotic (MZ) than dizygotic (DZ) concordance lending support for a genetic effect (Hrubec & Omenn, 1981; Kendler, 1985; Gurling, 1981; Pickens et al., 1991; Caldwell & Gottesman, 1991). This area of research has been criticised for failing to take account of unequal family environments in MZ and DZ families. The concordance effect in regard to alcoholism for MZ twins may be influenced by the increased incidence of MZ twins living together in adult life (Cook, 1994). This raises the question as to whether twin study methodology is appropriate for studying causal links in alcohol addiction. For this reason the data gathered from twin studies, although suggesting a significant genetic effect in alcoholism, should be regarded with caution.

#### **2.1.1.2 Adoption studies**

Adoption studies have provided strong evidence of genetic influence with a similar increased risk found in the adopted out sons of alcoholics with non alcoholic adoptive parents (Anthenelli and Schuckit, 1990). The studies undertaken by Goodwin, et al. (1973; 1974; 1977) found the incidence of alcoholism to be four times greater for male adoptees. The position with regard to female adoptees is different, with Goodwin's data failing to reveal any difference between adopted daughters of

alcoholics and controls. Goodwin included controls in his well designed studies. The work of Cadoret and Grath (1978), and Cadoret et al. (1985; 1987) confirmed the genetic findings in males, and for the first time the genetic links were also found in females.

### **2.1.1.3 Biological markers**

Studies of biological vulnerability to alcoholism are still in their infancy with much work still to be done (Anthenelli and Schuckit, 1990). One method employed in looking for trait markers is to study non-alcoholic young adults who have one or more alcoholic parent. The terminology of family history positive is applied (FHP) to this group, and family history negative (FHN) to controls who do not have family history of alcoholism. This design is limited in that it can not distinguish genetic from environmental factors. The following trait markers have been implicated within the current research and inform the area.

### **2.1.1.4 Trait Markers**

Studies on potential electro-physiological markers indicate reduced amplitude and increased latency of the P300 event related potential, in both alcoholics and their non-alcoholic sons and daughters (Polich et al., 1988). This suggests that the conduction of nerve impulses along axons will be impaired, slowing down the transmission of information within the central nervous system. However the evidence in this area at this time is inconclusive (Anthenelli and Schuckit, 1990). There is some evidence to suggest links in hormonal markers. Studies in this area have indicated that levels of prolactin are lower in FHP males following ingestion of ethanol, than FHN males (Schuckit, 1984). Many studies have investigated the links between levels of monoamine oxidase (MAO) activity in alcoholism (Cook, 1994). With low levels of MAO neurotransmitter activity level found among problem drinkers (Cloninger et al., 1981). This research is potentially important because of the links between MAO and affective disorders, such as depression, which are themselves associated with problem drinking (Davidson and Ritson, 1993). However it is unclear as to whether this low level of neurotransmitter activity is a result of excessive alcohol intake and whether it returns to normal after long periods of abstinence. Further work is required before



anything conclusive can be stated in regard to support for biological markers of vulnerability.

Neurophysiological markers have also been investigated. A study carried out in Los Angeles by Ozkaragoz and Noble (1995) of 117 males between the ages of ten and fourteen years provides some evidence to suggest that the sons of problem drinkers demonstrate reduced performance in memory and visuospatial tasks as well as attention and visual scanning tasks. This study supports earlier work in the field implicating neurophysiological markers (Wilkinson and Carlen, 1980; Ryan and Butters, 1983). Differentiation between genetic and environmental influences in regard to these deficits in cognitive function are not known. However it is possible that with further work in the field for they could act as predictors indicating the risk of becoming a problem drinking. Further research is required to investigate whether these deficits affect educational standards of attainment. Other studies have indicated that the sons of alcoholics perform worse on educational attainment tests (Tarter et al., 1984; Hedegus et al., 1984). From the available evidence it can be suggested that genetic factors may partially mediate the neuropsychological morbidity of problem drinkers (Fein et al., 1990).

#### **2.1.1.5 Genetic Marker**

The search for a genetic marker that would indicate increased vulnerability to problem drinking has been ongoing. The recent work of Blum et al. (1990) employing DNA markers suggested a link between problem drinking and the A1 allele of the dopamine D<sub>2</sub> receptor gene. This work requires to be replicated by others to establish a link that this receptor gene is a loci for susceptibility to problem drinking. This work can be linked to the work of Cloninger, (1987) and Modell et al. (1990) who proposed theories of craving and loss of control attributable to dopaminergic dysfunction.

The possibility of genetic mediators that influence alcohol consumption have been put forward in the last ten years. It has been suggested that certain inherited pharmacogenic factors may lessen the reaction to alcohol (Cloninger, 1987). Requiring greater quantities of alcohol to be consumed in order to become

intoxicated. It has also been suggested that hereditary deficits of a biochemical nature, or physiological response, may be corrected by consuming alcohol (Kent et al., 1985).

Although this work is still in its infancy suggested genetic links with serotonin metabolism have led to the use of pharmacokinetic drugs which modulate serotonergic neuro-transmission. These drugs have been indicated as possible treatments for problem drinkers (Naranjo et al., 1990). Three drugs which influence neurotransmitters have been implicated. These are serotonin re-uptake inhibitors such as Fluoxetine and Acamprosate and the third is an opioid antagonist called Naltrexone. European studies using Acamprosate with 4,000 patients produced a 50% reduction in drinking days (Chick, 1995). Acamprosate has a chemical structure similar to gamma amino butyric acid (GABA). Although the mechanism is not clearly understood it is thought to work by restoring the neural balance that is linked to reducing craving for alcohol. It is not seen as a treatment in isolation but may be useful in conjunction with other aspects of treatment. In the future it may be possible to introduce alcohol patches to be used in a similar way to nicotine patches (Chick, 1995).

#### **2.1.1.6 Personality**

The concept of an addictive personality is one which has been perpetuated for nearly fifty years, with the research producing some support for an association between certain personality traits and the development of problem drinking. The evidence is stronger for the traits indicative of antisocial personality disorder (Winokur et al., 1971; Windle, 1990), this also includes hyperactivity, and undersocialised aggression traits in children (McCord and McCord, 1960; Robins, 1966; Gomberg, 1982; Jones, 1968; Tarter et al., 1977). The following traits have been indicated but await confirmation from future research : neuroticism (Mullan et al., 1986); external locus of control (Windle, 1990); borderline personality disorder (Loranger and Tulis, 1985). However the research that has been undertaken in this area has failed to establish any causal link between problem drinking and any specific type of personality.

Vaillant (1983) reviewed six longitudinal studies of personality which attempted to find predictors of problem drinking in adolescents who were followed up into adult life. Vaillant's criticisms of the research available was that there were methodological weaknesses in all of them. In particular the work of McCord and McCord (1960), and Robins (1966) was criticised for introducing a sample bias in favour of antisocial behaviour (Cook, 1994). In the review Vaillant, citing from his own research, reported that the predictors of alcohol abuse in adult life were family history of alcohol problems, ethnicity, and behaviour problems in adolescence. He found no evidence to support the view that premorbid personality is a predictor of problem drinking behaviour in adults. This lack of support for an alcoholic personality profile was supported by Schuckit (1983) who found few baseline group differences in laboratory studies of highly functioning young men using the following outcome measures: the Minnesota Multiphasic Personality Inventory (MMPI); Eysenck personality inventory; Rotter's locus of control; Spielberger state trait anxiety inventory.

With little support for premorbid predictors of personality traits in regard to the aetiology of problem drinking why do many people including alcohol counsellors still speak about 'addictive personalities'? One explanation may be that as a consequence of problem drinking people display similar dysfunctional personality traits. The evidence from the current available research does not support the use of personality as an explanation for the aetiology of becoming a problem drinker.

#### **2.1.1.7 Socialisation and familial links**

What is it in families that exerts such a powerful social influence in regard to learned drinking behaviour? Several psychological theories have been put forward as explanations to account for problem drinking behaviour. These include explanations that demonstrate the powerful influence on behaviour learned within families. The theory of social learning or modelling indicate that drinking behaviour is learned by observing the behaviour of parents and peers. This theory is supported by the work of Bandura (1977) and Orford (1985). The work of Orford explains how choices in behaviour are balanced between the positive expectations of intrinsic rewards such as pleasure and expectations of negative social consequences. Craving for alcohol in

addiction can be linked to this balance of expectations. The work of Marlatt and Gordon (1985) expands on this theoretical link and is discussed more fully in relation to the compensatory model.

An alternative explanation has been generated from the work of people who examine problem drinking in relation to family roles and rituals (Wolin et al., 1979; Bennet and Wolin, 1986). This explanation takes account of the way in which certain rituals, routines, traditions play a role in maintaining and preserving the beliefs and values within families. It has been suggested that where families maintain these rituals despite one or more parent being a problem drinker then there is less risk of children also becoming problem drinkers. It has also been found that where the children of problem drinkers form their own rituals following marriage, they are at less risk of becoming problem drinkers (Bennet and Wolin, 1986). The research in this area is scant, although the model is a useful one as it has implications for preventative interventions taking a family therapy approach. It should however, at this time be regarded with some scepticism.

Indications from the research (McCord and McCord, 1960; Robins, 1966; Vaillant, 1983; Brown and Anderson, 1991) suggests that while family atmosphere and influence contribute to the development of alcohol problems in later life, a significant fraction of the association between alcohol abuse in parents and in children is genetically, rather than environmentally, transmitted. Vaillant (1983) studied 51 FHP men who had few environmental weaknesses, 27% subsequently became problem drinkers. In contrast the 56 FHN men with many environmental weaknesses only 5% became problem drinkers. This work suggests that although having a parent who is a problem drinker increases the likelihood of experiencing childhood problems, childhood problems are not themselves causally implicated to becoming a problem drinker (Cook, 1994). Other factors such as cultural influences and occupation have to be considered in regard to socialisation.

### **2.1.2 Cultural influences**

The early work of the sociologist Bales (1946) highlights the links between culture and social organisation and the aetiology of problem drinking. He provides evidence

from studies of Jewish and Irish people living in New York, suggesting that cultural influences are responsible for affecting how often and how much people drink. Later research on the influences of culture and subculture also highlights the influences of other variables, such as educational level, peer influence, age, and sex in determining consumption levels (Heather and Robertson, 1989).

Implicit within the work undertaken by Bales is the suggestion that people drink as a coping strategy to deal with stress in their lives. Alcohol is consumed to alleviate stress and drinking behaviour is reinforced. There have been a few prospective studies that lend support to this argument. Studies on normal populations following major disasters (Gleser et al., 1981; Adams and Adams, 1984) have found that alcohol consumption has increased following these disasters with some evidence of increased incidence of problem drinking. Other studies involving life event stress such as divorce and job crisis have found similar results (Cook, 1994). The evidence here is weak, other studies have been undertaken and have reported non-significant findings (Cook, 1994). The evidence to support Bales theory is stronger in relation to the effects of stressful life events on existing problem drinkers (Linskey et al., 1987; Tatossian, 1983; Morrissey and Schuckit, 1978). Linsky et al. (1987) undertook a large retrospective study in America, and reported a large correlation between all indices of problem drinking investigated. The highest correlation was related to social support and drinking behaviour.

#### **2.1.2.1 Social influences through occupation**

The availability of alcohol as a key factor in determining alcohol consumption and risk of problem drinking has been previously indicated. It is therefore not surprising that the people most at risk are those who work in the drinks industry. Statistics relating to mortality from liver cirrhosis (Standardised Mortality Ratio, 1991 (SMR), cited in Paton 1994) indicate publicans, seamen, catering industry, members of the armed forces and airline pilots are 3-10 times more likely to die from cirrhosis. Paton suggests that people may be attracted to certain industries because of the increased availability of drink.

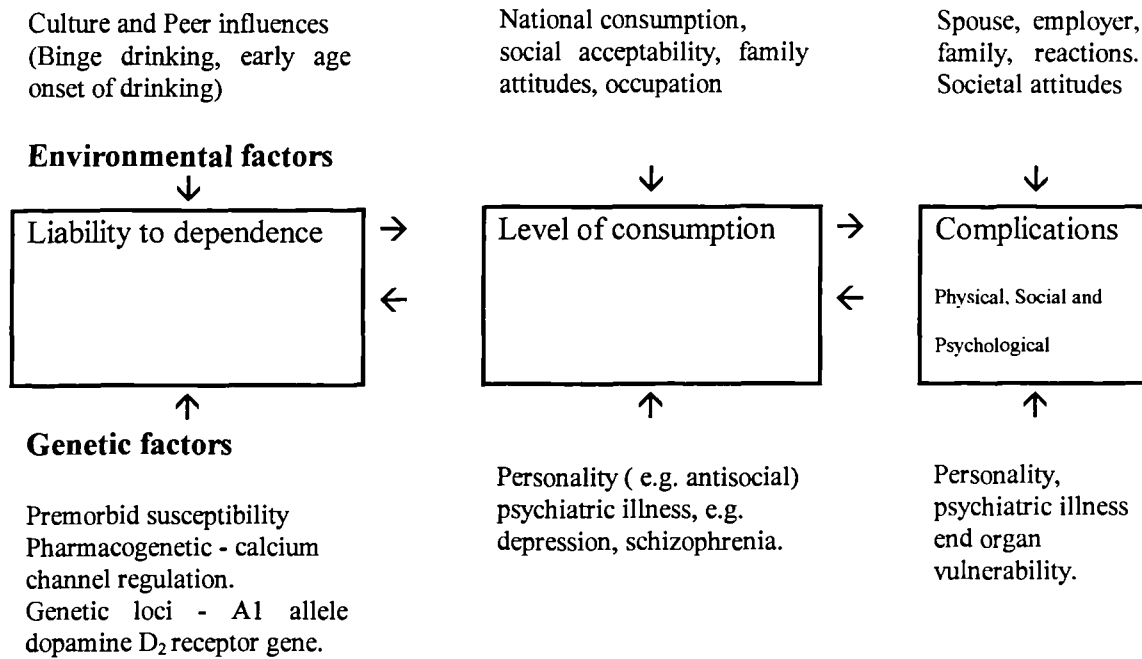
This suggestion has some support from a study carried out by Plant (1979) who investigated the drinking levels of men who were new to the brewery industry. This study showed that male brewery workers were drinking more than other males in other industries at the point of entry to their employment. Their drinking also increased subsequently over the next two years. This study highlights both a causative effect of employment alongside a selection of employment affect.

The SMR also highlights an association between alcohol misuse and professionals including doctors, this link is more likely to be related to stress associated with the job than to availability of alcohol in the workplace

### **2.1.3 Summary of aetiology**

The causes of problem drinking can clearly not be linked to any one area of research, or any one theoretical explanation. The interaction of environmental factors with individual factors are numerous and complex. Epidemiological research indicates that availability of alcohol is a key factor, with the mean alcohol consumption of the population being closely correlated to the prevalence of heavy drinking ( $r=0.97$ ) (Rose and Day, 1990). However this does not account for why only some people become problem drinkers. Genetic factors, social learning theory and familial studies can account for some differentiation in vulnerability between individuals.

Increased susceptibility is only one of many factors and what determines whether someone will become a problem drinker or not is determined by a complex interplay of the factors previously highlighted in this review and summarised in figure 1.



**Figure. 1** Model of environmental and genetic factors in the aetiology of alcoholism adapted from Cook, 1994

Cloninger et al. (1978) suggests that for each individual there is a liability threshold for the development of problem drinking. Above this threshold problems associated with heavy drinking will be manifest.

It can be seen from the evidence presented, that problem drinkers are not a homogenous group but very much a heterogeneous group. The indications from the literature reviewed suggests that although problem drinkers may share similar problems as the result of prolonged heavy drinking, there is little evidence to suggest that they share similar characteristics that would have predicted increased vulnerability. It may be more appropriate to consider that everyone has the potential to develop alcohol problems. These can be simply defined as adverse consequences resulting from the use of alcohol, with differing degrees of susceptibility to the problem among the general population.

The research investigating the genetic and social links with alcohol are important to inform medical, paramedical and other health care professionals in the best way to approach the problem. If alcohol dependence is viewed from the 'disease perspective' this would indicate the most appropriate treatment would be embedded within the medical model. On the other hand if dependence is viewed from the wider social perspective of the interplay of environmental and individual characteristics a different model of treatment will be required. The compensatory model can be viewed as an alternative model to the medical model.



## **2.2 MODELS OF PROBLEM DRINKING AND TREATMENT**

Different models have been put forward to inform treatment of the problem drinker. These models are underpinned by different assumptions related to both the aetiology of the problem and the treatment approach that is required. Although in recent years treatment approaches have become more eclectic there is a need to be informed of the strengths and weaknesses of the models that inform treatment. The models are dynamic and are liable to change with the advent of new scientific knowledge. However current knowledge of these models are being used to inform the planning of treatment services and the way that health service resources are being used and as such are pertinent to this study.

### **2.2.1 The medical model**

The early pioneering work of Rush (1785) and Trotter (1804) cited in Heather and Robertson (1989) was instrumental in attempting to have the study of problem drinking accepted as scientific and classified within medicine as a disease. This concept changed over the years being influenced throughout the nineteenth century by the work of the following European psychiatrists Esquirol (1838) Bruhl-Cramer, Magnus Huss (1852) and Emil Kraepelin (1901) cited in Heather and Robertson (1989). By the end of the nineteenth century the temperance movement was driving forward for prohibition and the disease concept was abandoned.

It was not until after prohibition and the publication of scientific research (Jellinek, 1952) identifying different phases in addiction, that the disease concept was once again popularised (Heather and Robertson, 1989). The scene was set and further scientific work followed (Jellinek, 1960; Edwards and Gross, 1976). The alcohol dependence syndrome described by Edwards and Gross (1976) gained world wide recognition and was incorporated into the International Classification of Diseases as a new medical diagnosis in 1977.

### 2.2.1.1 Assessment for Alcohol Problems

The classification of addictions comes within the remit of Psychiatry. As such the concept of problem drinking as a disease is based on the presence or absence of certain constellations of symptoms and behaviours. In taking the patient history the amount and pattern of consumption of alcohol is important (Cantwell and Chick, 1994). Obtaining a description of a typical days drinking, where, when and with whom. Also length of periods of abstinence are noted. The classification of alcohol dependence in ICD-10 (1992) is based on Edwards and Gross (1976) description of certain features associated with problem drinking. When three or more of these features are present this indicates a positive diagnosis (see table 1).

<b>Dependence</b> Criteria for positive diagnosis	<b>Dependence syndrome</b> Three or more experienced or observed at some time during the past 12 months
<b>Compulsion</b>	Desire /compulsion to take the substance
<b>Impaired Control</b>	Difficult in controlling behaviour in regard to onset, termination and level of substance taking.
<b>Withdrawal</b>	Physiological withdrawal state occurs when substance is withdrawn
<b>Relief Use</b>	Substance use to avoid or relieve withdrawal symptoms
<b>Tolerance</b>	Increased amount of substance required to achieve effect similar to lower dose
<b>Saliency</b>	Increased amounts of time spent in obtaining or taking substance or recovering from its effects.  Persistence despite awareness of harmful consequences.

**Table 1** Dependence Syndrome ICD - 10 International Classification of Diseases (1992) World Health Organisation

### 2.2.1.2 Screening Instruments and Laboratory Tests

The psychiatrist will also undertake assessment for any other psychiatric syndromes, familial history of alcoholism, cognitive impairment, and physical examination (Cantwell and Chick, 1994). Screening questionnaires and laboratory indicators are also frequently used. The screening questionnaires most frequently used to aid diagnosis range from the brief four question questionnaire CAGE produced by Ewing (1984) to the more detailed combined assessment instrument The Alcohol Use Disorders Identification Test (AUDIT) devised for the World Health Organisation (Babor et al., 1989). The CAGE, an acronym formed from the four questions that make up the screening instrument, has a cut off point of two positive answers and has been found to be as good in regard to sensitivity as longer screening instruments. However the specificity is poorer at around seventy five percent indicating a false positive rate of twenty five percent (Paton, 1994). The Michigan Alcoholism Screening Test (MAST) is one of the best known instruments and consists of twenty five questions which are administered during an interview (Bernadt et al., 1982).

Others include the Severity of Alcohol Dependence Questionnaire (SADQ, Stockwell et al., 1979) and the Short Form Alcohol Dependence Questionnaire the (SADD, Raistrick et al., 1983). The most frequently used laboratory tests include liver function tests such as the glutamyltransferase (GGT) and serum aspartate aminotransferase (AST) and by other tests such as the mean cell volume (MCV) (the size of the individual red cells in the blood may be increased by excessive drinking) and the Carbohydrate -deficient transferrin (CDT). This latter test has only recently been introduced in this country. CDT is an abnormal variant of human transferrin with a reduced sialic acid content. In early studies it has proved to be a reliable marker of chronic alcohol consumption (Borg, 1993). It can be used as a relapse marker to detect daily levels of high alcohol intake over a period of 14 - 16 days (Borg, 1993). In a comparative study Skinner et al. (1986) found that screening interviews had a higher sensitivity, at eighty percent, than laboratory tests such as GGT at forty percent. This suggests that interviews are more sensitive to detecting heavy alcohol consumption than laboratory tests. The laboratory tests however have high specificity meaning that if you are not a problem drinker it is most likely that

GGT will be negative. The use of laboratory tests and questionnaires will be further discussed in the methodology section, in relation to the current study.

### **2.2.1.3 Summary of diagnosis**

Diagnosis and treatment is currently informed by the existing scientific research regarding the aetiology of problem drinking . As the research in the fields of genetics pathophysiology and epidemiology are better understood new treatment and prevention strategies will follow for example the current Acamprosate drug trials (Chick, 1995). The medical model of problem drinking has been cited as being a useful one. Allowing legitimate access to medical treatment and reducing the stigma associated with socially unacceptable drunken behaviour (Heather and Robertson, 1989). This view is supported by Chick and Cantwell (1994) who suggest that offering a diagnosis of dependence enables the patient and family, to move away from the moral plane and to get access to treatment and support. However it can also be argued that medicalisation of the problem can lead to stigma by labelling the person as being ill or having a dependency on alcohol.

It has been suggested that one third of all patients seen in general psychiatric practice suffer from problems related to the addiction of alcohol or drug abuse (Frances, 1988). Within the concept of psychiatric treatment it is not only necessary for a correct diagnosis to be made but for the patient and family to accept the problem, and the treatment recommendations (Frances, 1988), often in the face of denial.

### **2.2.1.4 Treatment approaches based on the medical model.**

The rehabilitation model that was pioneered in alcohol and drug addiction includes group treatment, individual and family counselling (Frances and Alexopoulos, 1986). Self help organisations also play an important role in treatment. Organisations such as Alcoholics Anonymous (AA) founded in the USA in 1935 have been instrumental in perpetuating the belief that the problem drinker is a victim of the addiction and to regain control over their life the problem drinker must accept the AA beliefs and remain abstinent from alcohol throughout their lifetime. Strategies such as the 12 step programme advocated by Alcoholics Anonymous (see table 2) are the key to recovery with daily attendance at meetings recommended.

**Step 1** We admitted we were powerless over alcohol - that our lives had become unmanageable.

**Step 2** Came to believe that a Power greater than ourselves could restore us to sanity.

**Step 3** Made a decision to turn our will and our lives over to the care of God *as we understood him*

**Step 4** Made a searching and fearless moral inventory of ourselves.

**Step 5** Admitted to God, to ourselves and to another human being the exact nature of our wrongs.

**Step 6** We were entirely ready to have God remove all these defects of character

**Step 7** Humbly asked Him to remove our shortcomings.

**Step 8** Made a list of all persons we have harmed, and became willing to make amends to them all.

**Step 9** Made direct amends to such people wherever possible, except when to do so would injure them or others.

**Step 10** Continued to take personal inventory and when we were wrong promptly admitted it.

**Step 11** Sought through prayer and meditation to improve our conscious contact with God *as we understood Him*, praying only for knowledge of His will for us and the power to carry that out.

**Step 12** Having had a spiritual awakening as a result of these steps, we tried to carry this message to alcoholics and to practise these principles in all our affairs.

**Table 2. The twelve steps of Alcoholics Anonymous**  
from Cantwell and Chick (1994)

The philosophy of AA and abstinence is central to treatment programmes such as the Minnesota and Hazelden models of care (Cantwell and Chick, 1994). These models are highly structured programmes of care that include detoxification, where required, group meetings, individual counselling, education about the effects of alcohol, and attendance at AA meetings (Edwards, 1982). Within these programmes ex-alcohol misusers play a central role as therapists during rehabilitation. These models of care introduced in the early fifties are still current to-day in some private treatment centres

in both Britain and the United States of America. However in the United Kingdom most National Health Service alcohol treatment units have adapted these programmes (Cantwell and Chick, 1994). They are less reliant on untrained counsellors and there is less contact with AA. A range of therapies are included within a multidisciplinary approach serviced by psychiatrists, nurses, psychologists, social workers, occupational therapists and physiotherapists.

#### **2.2.1.5 Brief intervention versus intensive therapy**

The recent dilemmas that have been raised with regard to treatment include debate as to whether brief intervention is as effective as intensive therapy and whether abstinence should be the only goal for all problem drinkers. In considering the former issue the following studies lend weight to the arguments. One hundred male problem drinkers attending an out-patient clinic (Edwards et al., 1977) were randomly assigned to either intensive treatment, which included regular out-patient follow-up or six weeks inpatient care, or to a control group who received an assessment and one counselling session. At one year there were no differences between the two groups. These findings were supported by a more recent study undertaken in Edinburgh by Chick et al. (1988) This randomised controlled study followed patients up for two years and reported that extended treatment at this time had no advantage over the brief intervention. The study did find that overall harm associated with excessive drinking was reduced to a greater extent with the extended treatment group. The work of Kirstenson et al. (1983) also support the effectiveness of brief intervention.

The results of these studies however have to be viewed with caution. It has already been highlighted in the introduction that the effectiveness of any programme is poor with many problem drinkers returning to treatment (Booth et al., 1992). The results of these studies may be more indicative of the natural history of the condition than of any long term improvement from treatment. This need for caution in the interpretation of findings is highlighted by Cantwell and Chick (1994). They cite randomised controlled studies where brief intervention has been found to be better than a no treatment control group (Chick et al., 1985; Elvy et al., 1988) however they point out that the controls also showed improvement over time. This may

reflect both natural history of the condition or the difficulty in designing truly 'no intervention control groups' where contact to undertake screening interviews is necessary to determine inclusion criteria. The result of this contact can influence motivation to change. Most of these studies recruit people from out-patient referrals to alcohol clinics. People who have made the decision to present themselves for medical support are more likely to be in at least the contemplative stage of change and will have some motivation to change (Prochaska and Di Clemente, 1992).

#### **2.2.1.6 Abstinence or controlled drinking**

The other debate on whether abstinence is required for recovery or whether controlled drinking should be a goal choice option has received much discussion with regard to treatment approaches. Heather and Robertson (1981) eloquently debate this issue having reviewed the scientific evidence in the literature for the two approaches. They argue that the patient's wishes, beliefs, medical status, and the beliefs and attitudes of close family members should be taken into account when planning a treatment programme. Where there is medical evidence such as liver damage, pancreatitis or brain damage then abstinence should be advocated. Where there is physical damage of a less severe nature then temporary abstinence is advisable. Thorley (1980) cited in Heather and Robertson (1981) recommends a minimum of three months however Heather and Robertson (1981) suggest this may vary from two weeks upwards depending on level of drinking symptoms.

In advising patients whether controlled drinking really is an option of choice guidelines have been laid down which take account of vulnerability factors (Heather and Robertson, 1983; Chick 1992). The literature suggests that problem drinkers who are less dependent, have a shorter drinking history and fewer associated problems do best with controlled drinking (Cantwell and Chick, 1994). This area of debate has only limited support from clinical research. The Rand report (Polich et al., 1980) presented evidence to suggest that controlled drinking can be achieved for a small number of dependent drinkers. One further longitudinal study has supported this with evidence of long term controlled drinking with good social adjustment in patients treated at an alcohol problem clinic in Sweden (Nordstrom and Berglund, 1987).

### **2.2.1.7 Summary of treatment approaches**

The indications from the literature suggest that problem drinkers with more social problems and personality disturbance will be more likely to benefit from intensive treatment as an inpatient or attending an out-patient programme. Brief interventions appear to be more effective where the problem drinker is younger non-dependent on alcohol and socially stable (Ojehagen and Berglund, 1986) In these patients moderation can usually be considered an appropriate alternative to abstinence.

### **2.2.1.8 Role of drug therapies**

The management and approach to treatment of the problem drinker within the medical model of psychiatry has facilitated the role of drug therapies in treatment. Non-specific drugs such as thiamine, multivitamins and magnesium are frequently prescribed (Frances, 1988). The administration of medication for major alcohol withdrawal symptoms is required by only about 15% of problem drinkers (Naranjo et al., 1983). It is more likely to be required for patients with a history of epilepsy, malnutrition or other physical illness. Where required benzodiazepines are administered in a daily dosage which is reduced in a stepwise fashion over a period of five to seven days then stopped (Frances, 1988). Betablockers may also be used to ease psychological problems of withdrawal such as anxiety and tremulousness (Malka, 1988). All psychotropic drugs which includes minor tranquillisers, antidepressants, thymoregulators and neuroleptics may be used where circumstances indicate their use at specific time points within the patient's management (Malka, 1988).

Deterrent drugs such as disulfiram are alcohol sensitising drugs, leading to adverse symptoms when alcohol is taken. The use of these drugs have been found to be effective in maintaining abstinence where administration of the drug is supervised (Chick et al., 1992). It is not a treatment of choice for many problem drinkers who view the drug as a crutch that only delays the need for them to develop their own strategies to deal with the desire to consume alcohol (Cantwell and Chick, 1994).



As previously mentioned the beneficial effects of serotonin re-uptake inhibitors has been linked to fewer drinking days and lowered consumption (Naranjo et al., 1986). One suggestion as to why these drugs may help is their proposed link to altered brain activity associated with chronic alcohol consumption (Tollefson, 1989). The application of Naltrexone as an opioid antagonist has been found to reduce relapse in newly detoxified problem drinkers (Chick, 1995). The field of pharmacology in relation to the treatment of problem drinkers is rapidly developing. However it is unlikely to provide a single answer to the treatment of a problem in which social and psychological factors are as important as biological factors

### **2.2.1.9 Critiques of the medical model**

The medical model, also referred to as the disease model of addiction (Heather and Robertson, 1989) has been criticised both from a theoretical basis and from a scientific perspective with regard to the lack of clinical evidence to support practice in treatment (Heather and Robertson, 1989). Criticism of the model as applied to treatment focuses around the client being viewed as a helpless agent (McMahon and Jones, 1992). The philosophy of AA promotes this perspective stating that abstinence from alcohol can lead to a symptom free state, with the disease being arrested, but the problem drinker can not be cured (Edwards, 1982). A cure being anathema to their convictions. The rehabilitation of the client is seen to be dependent on the medical intervention and does not emphasise the clients motivation with regard to recovery, thus ignoring evidence for spontaneous recovery in problem drinking (Ludwig, 1985; Chick, 1992)

### **2.2.1.10 Current treatment in the NHS**

Many treatment programmes within the NHS Trusts in the United Kingdom have in the last decade taken the criticisms of the medical model on board and have opted for a more eclectic programme which is informed by the disciplines of psychology, and sociology as well as advances in pharmacology as cited earlier. Cantwell and Chick (1994) cite various specific therapies that may be useful in the management and rehabilitation of the problem drinker. These include, psychotherapy, couple therapy, group psychotherapy, aversion therapy and assertiveness training. The model of

care which best describes this newer philosophy has been referred to by Brickman et al. (1982) as the compensatory model.

### **2.2.2 Compensatory Model**

The compensatory model is a cognitive-behavioural explanation of dependence. Treatment based on this model requires an understanding of the interrelationship between thinking and behaviour, employing a range of strategies to facilitate adaptive thinking and behaviour.

In contrast to the medical model the cognitive-behavioural approach views the client as instrumental in assuming responsibility for his or her recovery through changing behaviour. This model views problem drinking as primarily a socially learned behaviour. More specifically the compensatory model sees drinking as an overlearned coping response to stress and as such the model is informed by the conceptual work of the psychologist Bandura (1977; 1984).

The concept of self-efficacy is central in regard to the process of coping. Bandura defines self-efficacy as a measure of a person's confidence to predict successful outcome from any chosen behaviour. This concept can be further explained by considering the problem drinker in a stressful situation. The decision whether to take a drink or use another activity as a coping mechanism for example relaxation, an exercise regimen or self-assertiveness is said to be dependent on the extent to which the person feels confident that they can perform successfully the chosen activity. Self efficacy seen in this way is important in recovery from alcohol addiction.

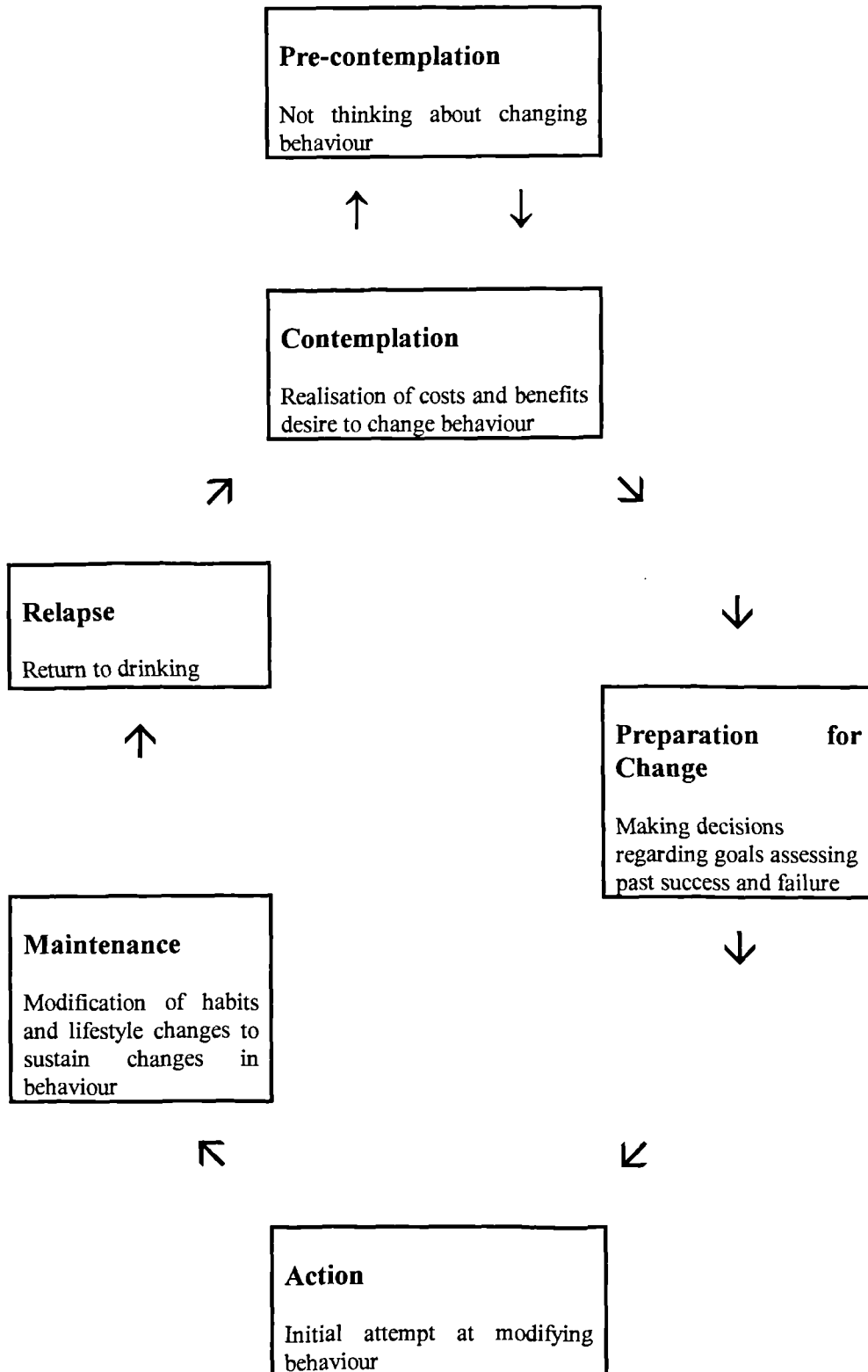
This model is central to Marlatt and Gordon's (1985) theory of relapse prevention and the notion that relapse is often caused by individuals encountering high risk situations with which they are unable to cope. Their approach suggests that recovery is dependent on developing coping skills and behaviours. Self efficacy develops by repeating and practising these skills. The problem drinker is seen as an active participant in this learning process, assuming responsibility for recovery and is not seen as a passive recipient of treatment.

### 2.2.2.1 Developing self-efficacy

The development of self-efficacy requires the problem drinker to be prepared to change their attitudes through a process of self appraisal. The perceived significance or importance of events are changed in line with the desired new behaviour, for example controlled drinking and abstinence. This change in beliefs and behaviours occurs by a process where newly acquired behaviours are repeatedly refined by performance feedback from others and self appraisal. Bandura (1977) emphasises this link between the beliefs about the outcome and the ensuing motivation to perform the behaviour again. The development of self efficacy can be seen to contain both cognitive and behavioural elements, with the problem drinker requiring to change beliefs and expectancies in line with developing new coping skills through practice.

In considering the cognitive-behavioural approach to treatment in relation to drinking one can understand the positive motivation to return to drinking where there may be expectations of improved friendships and intimacy (McCarty, 1985) or the removal of stress (Sher, 1987). These beliefs or expectancies may be very firmly established over many years.

Orford (1985) also supports the cognitive-behavioural account of dependence. He explains dependence as the confrontation between an awareness of the adverse consequences of the addictive behaviour and the desire to continue with an overlearned behaviour which is enjoyed valued and relied upon. This implies that motivation to change behaviour is not a static decision but a constant battle between the perceived costs and benefits of the behaviour. Within this model the cycle of relapse and return to drinking can be seen as something that may occur time and time again. The six stages in the process of behavioural change, as described by Prochaska and Diclemente (1992) highlight the different cognitive processes involved at each stage (see figure 2).



**Figure 2.** Stages of Change, after Prochaska and Diclemente (1992)

### **2.2.2.2 Cognitive-behavioural approach to treatment**

The model of stages of change coupled with the explanation of addiction as described by Orford (1985) enables cognitive-behavioural strategies to be appropriately planned for the different stages. It will therefore be beneficial to know which stage the problem drinker is at when intervention is being considered. Saunders and Allsop (1991) in considering the work of Orford and Prochaska and Diclemente suggest that intervention should be planned in four stages these are: resolution; commitment; action; and maintenance. The precontemplation stage is less likely to apply to anyone coming for treatment as that stage indicates satisfaction with their behaviour. However in some cases patients may be at the precontemplation stage and be attending for treatment as a result of pressure from others for example: spouse; family; doctor; or by necessity as the result of an occupational health or insurance company directive.

### **2.2.2.3 Contemplation - resolution**

The first stage of intervention focuses on the decision that change is felt to be necessary. In the last ten years motivational interviewing (Miller, 1983) has been used as a strategy to encourage a cognitive self appraisal of problems and concerns of recent drinking behaviour. It is seen as important that the problem drinker has carefully considered why they want to change their drinking behaviour (Miller and Rollnick, 1991). A distinct form of counselling developed by Miller (1983) has been used to enhance individuals resolve by helping them to face the realities of the situation and allowing them to decide what they wish their future behaviour to be.

### **2.2.2.4 Preparation for change - commitment**

The stage of commitment requires the problem drinker to participate in the planning of short and long term goals, with regard to their outcome desire. Whether that is abstinence or controlled drinking. The criteria for selection of these two distinct outcomes has previously been discussed in the section on this topic. At this planning stage it is important to give guidance on a range of behaviours and coping strategies that can build confidence (self-efficacy). The importance of self efficacy has been repeatedly demonstrated as a prognostic factor of change (Annis, 1986). However

overconfidence may be present due to cognitive impairment with an unrealistic optimism about the ability to change behaviour (Allsop et al., 1992, cited in Saunders, 1994). This preparation for change stage is seen as important with regard to firming up the commitment to change. Not infrequently problem drinkers may take up treatment without having thought carefully about the commitment and the difficulties that they will face (Saunders, 1994).

#### **2.2.2.5 Action**

In the action stage it has been shown that learning coping skills improves outcome of treatment (Heather and Tebbutt, 1989). The range of skills useful for coping include relaxation skills, assertiveness training, stress management and problem solving skills. See Monti et al. (1989) for a clinical guide to these and other methods.

Currently there is interest in the use of 'cue exposure' as a treatment to reduce the incidence of relapse. This work can be explained by considering 'impaired control' as a symptom that is central to addictive behaviour associated with problem drinking. To enable the problem drinker to improve their control, they are exposed to a powerful cue for further drinking. The exposure to a small number of drinks enables the problem drinker to practice resisting the urge to drink more. They learn that it is possible to regain control and resist the powerful cues by frequently repeating the behaviour (Saunders, 1994). Conditioning theory underpins this work with the conditioned response in the above example being the desire to drink more which is gradually extinguished as control is learned. This practice can be linked to any powerful cue such as feelings of anxiety particular environmental or situational cues etc. The short and long term benefits from this treatment approach are currently being investigated, with the potential having been identified several years ago (Drummond, 1990).

#### **2.2.2.6 Maintenance**

Social factors are also very important in the maintenance of change. Prochaska and Diclemente (1986) highlighted that social support such as the quality of familial support and opportunities for employment were vital in relation to the maintenance of change. These issues are critical to decisions with regard to contemplation and

readiness to change. The presence of friends, close partner relationships, and group contact have all been found to be significantly associated with good outcome in giving up alcohol (Havassy et al., 1991; Billings and Moos, 1983).

#### **2.2.2.7 Relapse**

Relapse from desired behaviour to familiar less desirable behaviour can be observed in all human behaviour. This can be seen in regard to changing behaviour for health benefits and the rates of relapse associated with undertaking exercise programmes (Biddle and Mutrie, 1991; Dishman, 1994). In relation to problem drinking relapse rates are high with ninety three percent of clinic attendees been found to return to problem drinking within four years (Polich et al., 1980). The relapse model proposed by Marlatt and Gordon (1985) features encounters with high risk situations and lack of successful coping as a key reason for the occurrence of relapse. The importance of social support in preventing relapse has already been stated. Relapse should not be viewed as failure. The likelihood of relapse at some point and the action required to get back into the cycle of change at the appropriate stage has been clearly described by Marlatt and Gordon (1985). Some people who relapse may move quickly back into the action stage (Trimpey, 1989).

#### **2.2.2.8 Critiques of the compensatory model**

The compensatory model, as described by Brickman et al. (1982), was not informed by the stages of change framework (Prochaska and Diclemente, 1993). The model, although giving a clear explanation of the role of self-efficacy and the importance of motivation, lacked a critical appraisal of the role of motivation in this process. It can be argued that motivation is not an intrinsic or stable personality trait which is either present or absent but motivation can be viewed as salient and situationally specific (McMahon and Jones, 1992). The relationship between the problem drinkers' expectations of the costs and benefits of alcohol and motivation to change have been greatly informed by the work of Prochaska and Diclemente in the last decade (Prochaska and Diclemente, 1982; 1986; 1992; Prochaska et al., 1993; 1994). The cognitive-behavioural approach is broader and is both a model for understanding addiction as well as a treatment approach. The evidence to support this approach in treatment is gaining acceptance with regard to the cost-effective management of the

patient (Saunders, 1994). Martha Sanchez-Craig has undertaken several studies demonstrating the benefits of the cognitive-behavioural approach in goal setting problem solving, cost effectiveness and maintenance of target behaviour (Sanchez-Craig and Walker, 1982; Sanchez-Craig et al., 1984; Sanchez-Craig and Lei, 1986; Sanchez-Craig et al., 1989).

There are gaps however in the research. For example there has been only one controlled study to evaluate the effectiveness of motivational interviewing (Saunders et al., 1994). The use of this approach as a counselling strategy to increase the likelihood of compliance with treatment is now being used within addiction clinics in the UK. (Saunders, 1994). The treatment approach has intuitive appeal and this is enhanced by the thoroughness with which the rationale of the approach is presented by Miller and Rollnick (1991). However it does lack scientific evaluation.

A further criticism of this approach is that in the clinical setting the notion of the interaction between the individual and their social world may be overlooked with clinicians focusing on individually oriented counselling (Saunders, 1994).

In the past there has been a lack of voluntary organisations in the community who advocated the principles of the cognitive-behavioural approach. This however is now changing with the advent of self help groups in the USA, offering a cognitive-behavioural alternative to the spiritual philosophy of AA. Currently there are around a hundred of these groups called Rational Recovery (RR). These groups are run by volunteers who follow the RR text (Trimpey, 1989) to offer a viable cognitive behavioural approach as an alternative to AA. The groundwork of this voluntary group may soon be well enough established to enable links to be made between treatment centres and the voluntary organisations in the USA. These groups are not yet established in the UK precluding the necessity for further detail of the approach in this chapter. It is however recognised that there is a need in the UK for community based support groups that link with, and augment the work undertaken in alcohol treatment clinics (Saunders, 1994).



### **2.2.3 Summary of the medical model and cognitive-behavioural approach**

The cognitive-behavioural approach although conceptually different from the medical model has been embraced within some NHS treatment centres within the UK as part of the management of the problem drinker. As mentioned previously a more eclectic approach to treatment is being offered that utilises the best from both approaches.

The benefits associated with the medical model include the appropriate use of drugs in therapy, the opportunity for associated physical and mental health problems to be diagnosed and treated, and access to a range of professional services that increases choice in treatment.

The work of Sanchez-Craig (1990) within the cognitive-behavioural approach stresses the importance of choice and the need for problem drinkers to accept greater responsibility for therapeutic change. The cognitive-behavioural approach allows the problem drinker to take responsibility for their own behaviour and enables them through the development of coping strategies to make informed decisions regarding lifestyle changes.

### **2.2.4 Effectiveness of current treatment**

The long term success of treatment is poor with 93% of people returning to drinking within four years (Polich et al., 1980). It is difficult to compare the outcomes of treatment reported in the literature. This is due to the differences in methodologies used. Several studies have used data gathered from a variety of treatment settings, for example Armor and Stambul (1978) and Cronkite and Moos (1978) have reviewed treatment programmes undertaken in a variety of settings: out-patient and in-patient alcohol specialist clinics; psychiatry out-patients; hospital in-patient. The variables between studies include different types of intervention (Smart, 1978), different time scales in lengths of programme intervention (Walker et al., 1983) and gathering of follow-up data (Vaillant, 1983). There have been fewer evaluation studies of outcomes undertaken in the UK (Sobell et al., 1987). The review literature suggests that outcome variance with regard to social support and employment are factors predicting successful intervention (Ornstein and Cherepon, 1985). While the relationship between treatment factors such as content of programme, length of

inpatient or outpatient contact are seldom reported to be significantly linked (Armor and Stambul, 1978; Stinson et al., 1979). In a follow-up study of problem drinkers offered a goal choice option of abstinence or controlled drinking Booth et al. (1992) reported that at one year post-discharge only 27% were successful in attaining their desired goal. These findings were said to be similar to the findings for programmes offering abstinence as their only goal.

The importance of developing coping strategies and behaviours that will enhance self efficacy are seen as paramount to the cognitive-behavioural approach. The importance of short and long term goal setting and the need to make lifestyle changes have all been stressed. The usefulness of exercise as a choice of treatment within a cognitive-behavioural programme would seem appropriate. It requires the setting and achieving of both short and long term goals and can be an effective route to improving self efficacy. Exercise participation can also provide opportunity for enhanced physical and mental health. It can be part of a lifestyle change offering opportunities to attend different social settings than those previously associated with drinking behaviour. Social support from families may be enhanced by participating in a behaviour that is encouraged within the general population and indicates a willingness to take responsibility for and to promote one's own health. It is a lifestyle change that can involve partners, parents, friends and children.

## **2.3 EXERCISE IN THE REHABILITATION OF PROBLEM DRINKERS**

This section gives an overview of the physiological and psychological benefits of exercise highlighting the potential use of exercise as a therapeutic adjunct to the treatment and rehabilitation of the problem drinker.

### **2.3.1 The therapeutic effects of exercise**

The benefits of undertaking regular exercise, a planned and structured programme of physical activity which may or may not be supervised, has been well documented (Biddle and Mutrie, 1991). The physiological benefits of exercise have been extensively reported in the literature. In addition to reduced morbidity in relation to cardiac disease (Bouchard et al., 1990), physiological health benefits have been linked

to prevention of chronic medical conditions such as diabetes (Gordon, 1993), osteoporosis (Marcus et al., 1992), and arthritis (Neuberger et al., 1994).

It is only in the last twenty years that the psychological benefits associated with exercise have been receiving greater attention (Rejeski and Thompson, 1993). These include decreases in anxiety (Morgan, 1985; deVries, 1981; Moses et al., 1989; Petruzzello et al., 1991), decreases in depression (Greist et al., 1979, Martinsen 1987, 1990; Martinsen et al., 1989a; Doyne et al., 1987; Mutrie, 1987; North et al., 1990), and improved self-concept (Folkins and Sime, 1981; Lewin et al., 1992). The recent historical review of exercise psychology undertaken by Rejeski and Thompson (1993) suggests that an increased understanding of the relevance of the biopsychosocial model and its application to clinical practice (Engel, 1980), has prompted this focus. In addition the research efforts of exercise psychologists have established a body of knowledge that links the importance of self perceptions, physical abilities and feelings of self worth to mental health (Rejeski and Thompson, 1993; Plante, 1993).

There is general agreement on the psychological benefits associated with exercise. These were agreed during a workshop funded by the American National Institute of Health with fifteen of the world's leading researchers in exercise psychology. These benefits have been summarised in the consensus statements produced from that meeting (Morgan and Goldston, 1987) and are reproduced in table 3. These views have been widely accepted and were more recently further endorsed by The International Society of Sport Psychology (1992). There is also general agreement that the mechanisms which underpin these positive effects from exercise are not yet clearly established (Biddle and Mutrie, 1991; Plante, 1993).

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

**Table 3. Consensus statements relating to exercise and mental health**

Morgan and Goldston 1987, page 156.

### **2.3.2 Mechanisms underpinning psychological change**

Three different mechanisms have been suggested to account for the psychological benefits of exercise: the physiological hypothesis; the biochemical hypothesis and psychological hypothesis.

The physiological hypothesis is based on evidence to suggest a link between whole body warming and mood ( Berger, 1985) and the decreased cardio-vascular

physiological response to stress. The body warming or thermogenic model of explanation suggests whole body warming reduces muscle tension and self reported state anxiety (Raglin and Morgan, 1985). The duration of exercise is said to be important with 30 minutes or less being more effective in producing anxiolytic effects than longer periods of exercise (Peruzzello, 1991). The cardiac influence model suggests that changes in mood may be result of the effects of changes in the central nervous system arising from muscular and autonomic activity during exercise. Increased alpha waves detected during EEG examination supports this theory of cortical activation (Boutcher and Landers, 1988) lending some support for the reduction in anxiety and depression following exercise. Dienstbier (1989) offers an explanation of 'physiological toughness' suggesting that repeated exposure to stressors reduces basal sympathetic nervous system arousal and enables the body to respond to stressful situations quickly and efficiently. Regular exercise can act as a repeated physiological stressor to the cardio-vascular system, producing a built in protection against feeling stressed, with fewer physical cues to which depressed attributions may be made (Cooper, 1968; Crews and Landers, 1987). A further physiological hypothesis advanced by Baxter et al. (1985) suggests that during affective illness there may be local disturbances in brain oxygenation and metabolism. Sime (1987) claims that aerobic exercise is associated with an increase in brain oxygenation.

The biochemical hypothesis suggests that the antidepressant effect may be explained by increased aminergic transmission (Ransford, 1982) and short term increases in norepinephrin levels (Dimsdale and Moss, 1980). Morgan (1985) also speculated that the positive benefits to mood change and feeling of well being, following exercise, were related to the increased circulatory levels of neurotransmitters such as serotonin, noradrenaline and endorphins. A deficit of circulating levels of these neurotransmitters has been associated with depression (Pary et al., 1988). Circulating beta endorphin levels appear to increase with endurance exercise (Carr et al., 1981, Howlett et al., 1984). The biochemical and physiological hypothesis would seem to suggest that aerobic exercise would be more beneficial than non-aerobic exercise in improving mood and feelings of well being. The current evidence from research does not support this with the benefits of both forms of exercise being

linked to lowered depression and anxiety (Seraganian, 1993). This allows for a third possible explanation the psychological hypothesis.

The psychological hypothesis is less dependent on mechanisms of biological change and therefore lends itself to both aerobic and non-aerobic exercise. Bahrke and Morgan (1978) suggest that the psychological benefits associated with exercise may be due to distraction from a stressful stimuli, or taking 'time-out' from a daily routine. This explanation however does not dispute the fact that physiological changes may occur. For example EEG alterations and temperature influences, as these changes may also occur during distraction activities such as meditation and relaxation (Morgan and O'Connor, 1988).

A further theory suggests that exercise resembles a graded-task assignment which develops a sense of mastery, and self efficacy, as concrete achievements are gained (Bandura, 1977; Beck et al., 1979). Perceived self competence (Harter, 1985) and self esteem (Sonstroem, 1976) have also been linked to this theory, suggesting that completion of an effortful task related to personal goals induces a sense of self-competence leading to higher self-esteem. Lewinson and Hoberman (1982) suggest a more behavioural explanation. This states that an activity which leads to a positive outcome for example feeling less depressed or less anxious, is likely to be repeated. A further explanation could be that people report feeling better following exercise and physical activity because they expect to feel better (Petruzzello, 1991). This is different from the theory of cognitive dissonance (Festinger, 1957). This theory suggests that people will find a way of justifying the time and effort that they put into their exercise by shifting their beliefs in a positive direction by believing the exercise is making them feel and look better.

It is clear that there is no one single explanation for the beneficial psychological therapeutic effects of exercise. As improved methods of accurately measuring circulating levels of neurotransmitters in the central nervous system become available more knowledge will be disseminated in regard to the biochemical hypothesis and a causal rather than a speculative link may be established. It is however more than likely that both biological and psychological underpinning mechanisms are involved. The psychological explanations of mastery and self efficacy are particularly relevant

to the exploration of the therapeutic effects of exercise with problem drinkers, taking account of the previous discussion in developing self efficacy in the section on the compensatory model. Feelings about the self, and self esteem are said to be central in recovery from mental health problems (Rejeski and Thompson, 1993) with self esteem and self efficacy closely linked to relapse prevention in problem drinkers (Marlatt and Gordon, 1985; Annis, 1986).

### **2.3.3 Overview of literature on psychological benefits of exercise**

In order to review the literature related to exercise and psychological well being it is necessary to define exercise more clearly. The American College of Sports Medicine (1980) divides exercise into the following three categories: aerobic exercise - the training of aerobic capacity and endurance; non-aerobic exercise - the training of muscular strength and endurance; and exercise to improve flexibility. The first two categories of exercise require an elevated metabolic rate and have been most frequently used in studies exploring the relationship between exercise and mental health. This research has been undertaken with patients in health care settings and population studies which typically describes relatively healthy individuals who are not exposed to interventions. The distinction in the research is important as recent reviews suggest that there is more evidence to support that mental-health benefits of exercise are limited to more distressed individuals (Brown, 1990; Harris et al., 1989; Sime, 1990).

The use of criteria-based diagnosis in Psychiatry has greatly increased reliability between independent researchers when classifying a patient as having a mental health problem. For example being diagnosed as clinically depressed or as being classified as a problem drinker. The most commonly used systems are the Research Diagnostic Criteria or RDC (Spitzer et al., 1978), the Diagnostic and Statistical Manual of Mental Disorders, or DSM III (American Psychiatric Association, 1980 ) or DSM IV (American Psychiatric Association, 1994) International Classification of Diseases ICD 10 (1992). Rating scales such as the Beck Depression Inventory , (Beck et al., 1961) give scores that indicate normal ranges and symptomatic ranges. This validated instrument is frequently used in intervention studies to look at changes in symptoms over time. Where it is used as the sole means of classification and no

formal diagnosis is given it is less satisfactory as it makes comparison across studies more difficult.

#### **2.3.4 Exercise and depression**

The earlier studies that investigated the psychological benefits of exercise in relation to affective mood changes, tended to focus on aerobic exercise. These included small-n design studies (Blue, 1979; Buffone, 1981) and group designs (Greist et al., 1979; Reuter, 1982; Doyne, 1983; McCann and Holmes, 1984; Klein et al., 1985; Martinsen, 1985; Freemont and Craighead, 1987; Sexton et al., 1989). Later studies investigated the effects of both aerobic and non-aerobic exercise such as weight training or strengthening and stretching (Doyne et al., 1987; Mutrie, 1987; Martinsen et al., 1989a). These group studies were either quasi-experimental or randomised design and are reported here in more detail. The rationale for including details of studies with patients who have been diagnosed as clinically depressed is the established link between the increased occurrence of mild to moderate levels of depression and problem drinkers (Davidson and Ritson, 1993). Studies will be discussed in relation to the design and methodological limitations of the study (see table 4).

Several studies followed a randomised design comparing aerobic exercise to another therapeutic treatment such as psychotherapy, counselling, or cognitive therapy. Greist et al. (1979) compared the effects of a 12 week running programme, to individual psychotherapy. Subjects were 28 patients attending an outpatient psychiatric clinic, who had been defined as clinically depressed using the Derogatis et al. (1973) subscale of the Symptom Checklist Ninety. The findings indicated that patients in both groups had mean reductions in their depression scores but there was no between group difference. See table 4 for details of population sample, and frequency duration and intensity of the exercise programme.



Study	Design	n	Sex	Clinical Diagnosis	Type of Exercise	Duration minutes	Frequency	Length of training	Comparison Group
Greist et al (1979)	Random no control	28	M, F	RDC criteria	Aerobic	60	3 x week	10 weeks	Psychotherapy
Reuter et al (1982)	Random no control	18	M, F	BDI	Aerobic	20	3 x week	10 weeks	Counselling / aerobic & counselling
Doyle et al (1983)	Multiple Baseline	4	F	BDI	Aerobic	30	4 x week	6 weeks	Own control
McCann & Holmes (1984)	Random control	43	F	BDI	Aerobic	60	2 x week	10 weeks	Relaxation / waiting list control
Klein et al (1985)	Random no control	74	M, F	RDC criteria	Aerobic	60	2 x week	12 weeks	Psychotherapy / Meditation
Doyle et al (1987)	Random control	40	F	RDC criteria	Aerobic / nonaerobic	not reported	4 x week	8 weeks	Nonaerobic & waiting list control
Martinsen et al (1985)	Random no control	49	M, F	DSM III	Aerobic	60	3 x week	9 weeks	Psychotherapy & Occupational therapy
Freemont & Craighead (1987)	Random no control	49	M, F	BDI	Aerobic	20	3 x week	10 weeks	Cognitive therapy (CT) / Aerobic & CT
Mutrie (1987)	Cross-over	24	M, F	GP Diagnosis	Aerobic / nonaerobic	Individual programme	not specified	4 - 8 weeks	No treatment / aerobic / nonaerobic
Martinsen et al (1989)	Random no control	99	M, F	DSM III	Aerobic / nonaerobic	60	3 x week	8 weeks	Nonaerobic

Table 4 Characteristics of the studies on exercise and depression with clinical population.

Reuter et al. (1982) quickly followed this up with a randomised designed study comparing 10 weeks of running and counselling to counselling alone. 18 depressed outpatients who scored symptomatically on the Beck Depression Inventory (Beck et al., 1961) participated in the 10 week programme (see table 4). The findings indicated a greater effect of treatment in the running and counselling group with significantly lowered scores of depression in this group.

A comparison of aerobic exercise and cognitive therapy was undertaken by Freemont and Craighead (1987). 49 depressed patients (Beck Depression Inventory) attending daycare facilities were recruited for this 10 week study (see table 4). All groups significantly lowered depression scores and this was maintained at two month follow up. In all of these studies the patient therapist contact time was three times greater for the running group, and so it is difficult to know if this had an effect on the outcome. Further limitations include no control groups and only the study by Freemont and Craighead had a short term follow-up, so evidence to support long term benefit from these studies is limited. The lack of between group differences in some of these studies limits the strength of these findings, however in the treatment of depression there is some evidence to support the following: aerobic exercise is as effective as cognitive therapy and psychotherapy; running and counselling are more effective than counselling alone.

These findings are supported in a randomised controlled study by Martinsen et al. (1985) comparing aerobic exercise to the standard treatment of psychotherapy counselling and occupational therapy. 49 patients meeting DSM III criteria (American Psychiatric Association, 1980) participated in either the 9 week aerobic exercise programme or the standard treatment (see table 4). The mean reduction in the depression scores was significant for the exercise group ( $p < 0.05$ ) who also achieved improved fitness. Although time in treatment was controlled for in this well designed study, the interpersonal effects of the therapist was not.

These findings are further supported by Klein et al. (1985). This study had fewer methodological weaknesses controlling for contact time and undertaking a 9 month follow-up. 74 outpatients diagnosed as meeting the Research Diagnostic Criteria (RDC) for minor or major depression (Spitzer et al., 1978) were randomly allocated

to one of three groups either running, group psychotherapy, or meditation. After 12 weeks there were no between group differences although all groups indicated within group reduction of depression. At the nine month follow-up the exercise and meditation groups had maintained their lowered levels of depression while the group in psychotherapy had shown slight increases in depression scores.

None of these studies had a waiting list control group so the effects of spontaneous change in depression over time had not been eliminated. This was addressed by McCann and Holmes (1984) they compared the effects of aerobic exercise to relaxation training in a randomised controlled study which included a waiting list control. 43 women diagnosed as symptomatic using the Beck Depression Inventory (1961) participated in the 10 week programme (see table 4). Depression scores were lowered in all groups with no significant difference between groups. The within group reduction for the aerobic group was greater than for the other two. There was an increase in aerobic capacity in the exercise group but not in the other two groups. The failure to find between group differences suggests that depression does lower naturally over time and that there is a need to control for this in future studies.

All of these studies had looked at the effects of aerobic exercise. This raised questions as to whether only aerobic exercise would be effective or whether non-aerobic exercise could also be effective in reducing depression. The exercise programmes had previously been 9 -12 weeks long, the effects of exercise programmes over shorter time periods had not been addressed. Three further studies informed these areas. Mutrie (1987) investigated the effects of aerobic and non-aerobic exercise over time periods of 4 weeks and 8 weeks with 24 patients diagnosed by their general practitioner as being depressed but not requiring psychiatric care. The study was a cross over design and controlled for most of the methodological weaknesses highlighted in the other studies. Aerobic exercise was more beneficial than non-aerobic exercise in reducing depression over 4 weeks, as measured by the Beck Depression Inventory. No change in fitness was noted at this time point for any of the groups. At 8 weeks lower levels of depression were found for all groups. This improvement was maintained at the 5 month follow-up. The study included a 4 week waiting list control and depression did not change spontaneously over time. The findings of this study strengthens support for the use

of exercise in the treatment of depression. The findings are of particular relevance to health care providers suggesting that as little as four weeks is required for exercise to have a beneficial effect in lowering depression.

Evidence for the effects of non-aerobic exercise in the treatment of depression was provided by Doyne et al. (1987). This study compared the effects of 8 weeks of running and weight training in a randomised controlled study involving 40 female patients diagnosed by the RDC criteria. Depression was monitored during the study using the Beck Depression Inventory, the Hamilton Rating Scale (Hamilton, 1960) and Lubin's Depression Adjective Check List (Lubin, 1965). Cardiovascular fitness was measured by estimated  $\text{VO}_2$  max. using a modified graded exercise treadmill test (Astrand and Rodahl, 1977).

The results demonstrated a significant reduction in depression for both exercise groups between pre and post scores ( $p < 0.01$ ) across all measures but not for the control group. In addition these changes were maintained through a one year follow-up. This study did not demonstrate between group differences in either depression or fitness in the exercise groups. The exercise programmes followed standard guidelines for exercise prescription (American College of Sports Medicine, 1980) and it is surprising that after 8 weeks no significant between group differences in fitness were found. The author suggests that either the treadmill test was not sensitive enough to detect real differences or that the intensity, or duration of the programme was not sufficient to improve aerobic fitness. The findings of this study indicate that the reduction in depression in both exercise groups was not dependent on improved fitness levels. Mutrie (1987) similarly found no correlation between lowered depression and fitness improvement. Limitations of the Doyne et al. (1987) study include large number of drop-outs at the intervention stage particularly in relation to the aerobic group (40%), this may confound the fitness results and may account for lack of evidence of aerobic effect.

Further support for the use of either aerobic or non-aerobic exercise in the treatment of depression was provided by Martinsen (1989a). Ninety-nine hospitalised depressed patients of both sexes, who met the DSM III R criteria for major depression, were included in a study to investigate the effects of an 8 week

programme of aerobic and non-aerobic exercise. In contrast to the study by Doyne et al. (1987) Martinsen found an aerobic fitness improvement in estimated  $VO_2$  max. in the walking and running, aerobic group only. A significant reduction in symptom depression scores was found using both the Beck Depression Inventory and the Montgomery and Asberg Depression Rating Scale (1979) for both exercise groups at eight weeks. Similar to Mutrie(1987) and Doyne (1987) the correlations between physical fitness and reduction in depression scores were low. Like Doyne et al. (1987) the findings of this study suggest that the antidepressive effects associated with exercise are not restricted to aerobic forms of exercise. The limitations of this study include lack of a control group.

The methodological shortcomings of the above studies makes it difficult to compare the results. Different diagnostic criteria and use of different instruments to assess the level of depression are a weakness. All instruments used were standardised measures, however not all of these studies included the use of a criteria-based diagnostic system. Small sample size, lack of consistency in patient therapist contact time, lack of consistency in measures of aerobic fitness and exercise prescription reduce the generalisability of these findings.

A greater weight of evidence with regard to the positive effects of exercise in the treatment of depression has been gathered from recent meta-analytic studies. North et al. (1990) provides evidence from nearly one hundred separate studies and demonstrates a positive effect size of 0.53. Confirmation of the weight of the evidence to support the application of exercise in treatment for depression is confirmed by Plante (1993). The research undertaken in this area is with a clearly defined clinical population unlike the research which investigates the effect of exercise on anxiety which is mostly undertaken with populations who are not clinically diagnosed as anxious.

There is now a fairly substantial body of evidence in the area of depression. This is further supported by population surveys which generally support the association between exercise and mental health benefits. Three major longitudinal studies from America and Canada provide evidence of this association (Farmer et al., 1988; Camacho et al., 1991; Stephens and Craig, 1989). However before a causal link can

clearly be established more knowledge is required in relation to the underpinning mechanisms and a greater number of randomised controlled studies require to be undertaken with standardised dependent variables and diagnostic inclusion criteria.

### **2.3.5 Exercise and anxiety**

The use of exercise in the treatment of anxiety and to facilitate stress reduction has been reviewed in two large meta-analytic studies undertaken by Petruzello et al. (1991) and Crews and Landers (1987). Petruzello et al. included 104 studies in three meta-analyses to explore the relationship between exercise and anxiety. Their findings indicated that the overall effect sizes were significantly greater than zero, suggesting that no matter how anxiety is assessed exercise is associated with a reduction in anxiety for aerobic forms of exercise. The variable of exercise duration was significant across the three meta-analyses. At least twenty one minutes of exercise appeared to be necessary to achieve reductions in state and trait anxiety. The study also indicated that for a reduction in trait anxiety training programmes required to be of at least ten weeks duration. These findings lend some support to the work of Crews and Landers (1987) who included thirty-four studies in their review and their findings indicate that no matter what measure was used to indicate stress, aerobically fit individuals have a reduced psychosocial response to stress. One of the weaknesses of the literature in this area is that the studies have included people who are not clinically diagnosed as being anxious. Many studies include volunteer subjects who have not presented with any symptoms of anxiety and therefore the literature should be considered alongside the literature for normal populations and not for clinical populations.

A small number of studies have been undertaken with patients with anxiety disorders. Early work was undertaken by Orwin (1974) with nine phobic patients. Patients were required to run to near exhaustion then exposed to an anxiety provoking stimulus. It was suggested that the arousal of the autonomic nervous system due to the exercise would inhibit the situational anxiety. This work was supported by similar case study examples undertaken by Muller and Armstrong (1975). A larger controlled study in this area was undertaken by Martinsen, et al. (1989b). Seventy-nine inpatients diagnosed using the DSM III-R criteria as being

clinically anxious were randomly assigned to either aerobic ( jogging or walking) or non-aerobic exercise (muscle strength, relaxation and flexibility). Patients undertook an hour of exercise, three times a week, over eight weeks. The aerobic group improved in fitness over the eight weeks and both groups achieved a significant reduction in anxiety although the between group differences were small and were not significant. The findings of the study are limited and should be interpreted with caution as no treatment control group was included and the reduction in anxiety could have occurred naturally over time, or as a result of time with the therapist.

The evidence to support the use of exercise as a treatment in psychiatry for patients with clinical anxiety is not as well developed as the research to support the use of exercise as a treatment for depression. Anxiety and depression are frequently found together in clinical depression (Davidson and Ritson, 1993). Problem drinkers attending for treatment demonstrate increased levels of anxiety (Stockwell and Bolderston, 1987; Palmer et al., 1988) with as many as 30%-44% of problem drinkers displaying symptoms of anxiety (Tollefson, 1989). As such it is worthy of considering in relation to the use of exercise as a treatment for problem drinkers.

### **2.3.6 Exercise, alcohol and lifestyle modification**

This section will focus on the literature that suggests that exercise has a useful role to play in the treatment of the problem drinker. Proponents of the cognitive-behavioural approach to the treatment of problem drinkers have emphasised the importance of developing lifestyle intervention procedures as a means of establishing self-control strategies as alternatives to excessive alcohol consumption (Marlatt and Gordon, 1985). The development of strategies and the successful application of them in different situations can lead to heightened self efficacy and enhanced self esteem (Bandura, 1984). In line with this thinking Murphy et al. (1986) carried out a stratified randomised controlled study to assess the effects of 6 weeks of exercise and meditation on alcohol consumption among heavy social drinkers. Sixty male student volunteers classified as heavy social drinkers were recruited to the study. They were ranked and matched on their drinking habits and randomly assigned to one of three groups, a running group, a meditation group, and a no-treatment control. There were a large number of drop-outs following group allocation and the data

gathered on the eight week programme is based on 13 runners, 14 meditators and 16 no-treatment control.

The findings of the study indicate that running in a regular programme can significantly reduce alcohol consumption in heavy social drinkers particularly in relation to week-day drinking behaviour. This study like other studies looking at the effects of exercise and alcohol addiction was not able to say unequivocally why the exercise had helped. Daily journals indicated that running was associated with increased feelings of well being, being more relaxed, dealing with stress, and 'time-out' from everyday pressures. The extent to which these findings can be generalised to clinical populations of problem drinkers or to a more general population of heavy social drinkers requires further investigation. There is currently only one study undertaken with problem drinkers that links regular exercise with abstinence from alcohol consumption. The weight of the evidence with this clinical population being linked to physiological and psychological benefits, the findings are summarised in table 5.



Study	Design	n	Sex	Clinical setting	Type of Exercise	Duration minutes	Frequency	Length of training	Outcome Measures & Outcome
Gary & Guthrie (1972)	Random control	20	M	California inpatient	Aerobic	Not reported	5 x week	4 weeks	Schneider fitness, Jourard body Cathexis ↑ fitness and self esteem in exercise group only Illinois fitness submax step MMPI ↑ fitness and ↓ anxiety & depression BP, skinfold, balance, grip strength. ↑ co-ordination & fitness
Frankel & Murphy (1974)	Single group pre-post	214	M	North America inpatient	Aerobic	60	5 x week	12 weeks	
T'sukue & Shohoji (1981)	Single group pre-post	25	M	Hiroshima inpatient	Aerobic	Not reported	3 x week	10 months	
Sinyor et al (1982)	Quasi-exp control at different centre	58	M, F	Quebec inpatient	Aerobic	60	5 x week	6 weeks	Est max VO <sub>2</sub> , skinfold, drinking report in experimental group at post test ↑ fitness and abstinence at 3 month follow-up ↑ abstinence maintained Est max VO <sub>2</sub> , Zung depression inventory, Spielberger State-trait anxiety inventory in experimental group ↓ anxiety & depression no change in fitness
Palmer et al (1988)	Quasi-exp control at different time point	27	M, F	North America inpatient	Aerobic ACSM (1980) guidelines	20-30	3 x week	4 weeks	
Donaghy et al (1991)	Random control 3 groups	37	M	Scotland	Aerobic & non-aerobic ACSM (1980) guidelines	30	3 x week	8 weeks	Est max VO <sub>2</sub> , BDI Depression Inventory, Leeds Scale, strength & flexibility ↓ anxiety & depression & ↑ strength in both exercise groups change in fitness in aerobic group only

Table 5 Characteristics of the studies on exercise with problem drinkers.

Exercise programmes designed to improve both aerobic fitness and muscle strength have been found to be effective in improving physical parameters of cardiovascular fitness and strength among problem drinkers (Tsukue and Shohoji, 1981, Palmer et al., 1988; Donaghy et al., 1991). There is also the potential that exercise may be effective in combating the negative effects of alcohol on skeletal muscle (Preedy and Peters, 1990) and bone mass (Peris et al., 1992). Exercise has the potential to improve self image and self esteem (Collingwood and Willet, 1971; Folkins and Sime, 1981) both of these psychological parameters have been found to be disturbed among problem drinkers (McMahon and Davidson, 1986) along with lowered self efficacy (Heller and Krauss, 1991) and increased depression (Davidson and Ritson, 1993) and high levels of anxiety (Stockwell and Bolderston, 1987).

The results of previous studies suggest that the exercise programmes provide the problem drinker with skills that may enable them to make choices regarding lifestyle and the development of self monitored coping strategies. The other underpinning explanations of why exercise may help are also appropriate to consider here. Feelings of well being, a reduction in feelings of depression and anxiety are all helpful to the problem drinker who is in the process of rehabilitation and change. The following studies have been undertaken with problem drinkers attending alcohol inpatient treatment programmes, and give an indication of the benefits of exercise in treatment. Because of their relevance to the current work reported in this thesis, they are presented in some detail in chronological order (see table 5).

Gary and Guthrie (1972) reported that hospitalised alcoholics who jogged a mile a day for twenty days improved their cardio-vascular fitness and their self esteem. The running programme consisted of training five days a week for four weeks (see table 5). Pre-and post measures included the Schneider fitness test, Jourard body cathexis, a self cathexis scale, Gough adjective checklist and a log of drinking behaviour. Thirty six inpatients at the Metropolitan State Hospital California, with an average drinking history of eighteen years, were randomly assigned to a treatment group or non-intervention control group. Only twenty completed, ten in the exercise group (mean age thirty-eight) and ten in the non-intervention control (mean age forty-five). The drop-outs were said to have left the programme because of conflicting activities.

Scores on the Self-Cathexis and Body Cathexis Scales support the hypothesis that self-evaluation would improve with increased physical fitness. A significantly lower level of sleep disturbance was reported but no change was evidenced in relation to number of drinking episodes after training. Although this study undertook an experimental design, the following problems may limit the internal validity: time the treatment group spent with the exercise leader which the control group did not have; the enthusiasm of the exercise leader and the social interaction of the running group. Either or both of these influences could account for the change in self esteem.

Another early study carried out on a group of problem drinkers by Frankel and Murphy (1974) confirmed fitness gains linked to psychological improvement. As fitness improved there were reductions in the level of depression and anxiety as measured by the Minnesota Multiphasic Personality Inventory (MMPI) (Hathaway and McKinley, 1951). This study was carried out with hospital inpatients in Salem in North America. It was a large study with 214 male subjects (mean age of 45) participating. The programme consisted of warm-up light callisthenics, strengthening, and group walk or jog. Progress was monitored to take account of individual needs. There were five one hour sessions per week, over a period of twelve weeks. The dependent variables were weight, pulse, blood pressure, a modified version of the Illinois standard test of physical fitness and the submaximal step test. The index of physical fitness, a simple linear function of the variables was validated against the thirteen MMPI scales with positive results. The data from MMPI support the hypothesis that depression is a cardinal characteristic of a person hospitalised for problem drinking.

On analysis of the data it was found that two of the MMPI variables contributed to the personality side of the correlation, a decrease in depression and blame projection were correlated with increases in performance on physical fitness. previous evidence points towards several MMPI profiles endorsed by hospitalised problem drinkers. This typology of MMPI profiles seriously challenges the idea of one type of alcoholic personality. This is supported by the more recent work of Schukitt (1983), on personality profiles. This has been mentioned previously within this chapter. The weaknesses of this study are the lack of a control group, and the difficulty of isolating the effects of exercise from the other therapeutic intervention, which included group

psychotherapy, designated work, family counselling and health education. There was also no follow-up data after discharge from the hospital, and no indication if improvement was maintained.

The focus on fitness continued with a study by Tsukue and Shohoji (1981) who investigated the effects of a three day a week basketball game over a ten month period with inpatient problem drinkers in a hospital in Hiroshima Japan (see table 5). The subjects were twenty-five males who had been resident in the hospital for at least six months. The dependent variables were waist and chest measurements, blood pressure, grip strength, skinfold, and measures of balance and control. The aim of the study was to enhance the problem drinkers self concept by increasing their physical fitness and to ameliorate neurological deficits. However, the study makes no attempt to measure self esteem, no standardised psychological measures were taken, and the measures of balance and co-ordination stated appear to be unstandardised and their reliability and validity is questionable. The dependent variables were undertaken at two monthly intervals. However, some of the subjects were assessed on six occasions and others only four times. The authors claim that the programme enhanced co-ordination, nurtured patience and friendship, and alleviated neurological disturbance. These claims are mostly anecdotal, there were no standardised test procedures undertaken to objectively measure these outcomes. This was a single group pre and post design study and as such the interpretation of the findings are limited.

Empirical support that fitness improvements help in the rehabilitation of the problem drinker, in terms of improved drinking outcome, were evidenced in a study from Quebec (Sinyor et al., 1982). This study was undertaken at an inpatient rehabilitation centre for problem drinkers. The participants in the study were 46 men and 12 women (mean age of 42). Following the Astrand Rhyming cycle ergometer test (Astrand and Rodahl, 1977) the subjects were assigned by fitness levels to undertake either a full or partial participation in the fitness programme. They attended a daily class five times per week for six weeks. Each class lasting approximately one hour and consisting of warm-up light callisthenics, a twelve minute walk / run and twenty minutes strengthening exercises. Outcome measures included estimated  $VO_2$  max. (Astrand and Rodahl, 1977), heart rate, body fat and three month and eighteen month

follow up abstinence report. The control group for this study was a comparable group of inpatients at another centre in Quebec and comparisons were also made with the subjects who participated at the lower level of intensity. At the end of the six week intervention programme the subjects who participated in the fitness programme had significantly improved their aerobic fitness. At the three month follow-up abstinence rates were sixty nine percent for residents during the time that the fitness programme was offered and thirty-six percent for residents of other treatment centres in Quebec. No follow-up data on fitness levels is reported. The authors stated that a partial eighteen month follow-up supported these findings. However the evidence to support this is not clear. The smaller number in this follow-up sample is not given and no statistical evidence is reported.

There are several confounding factors to be considered in relation to the findings of this study. There was no randomised control, the treatment regimens at the two centres may have differed and the center used as a control had addictions other than alcohol. There may have been cultural differences between the centres. The study centre conducted treatment in English, the other centres in Quebec were French speaking. With these limitations in mind, the findings of the study do indicate that exercise may have a beneficial effect in sustaining abstinence and for this reason the area is worthy of further investigation. The results also confirm the earlier findings of Tsukue and Shohoji (1981) that problem drinkers show fitness level improvements, similar to those for non problem drinkers, with an exercise programme. It is disappointing that no follow-up data relating to fitness was reported and the question whether improved fitness levels were maintained on discharge remain unanswered. Unlike the previous studies reviewed, the exercise programme in this study was consistent with the guidelines set forth in the American College of Sports Medicine (1980). No psychological measures were taken and the authors were unable to say why the exercise may have helped in the rehabilitation.

One of the most recent studies (Palmer et al., 1988) comes from North America and looks at the usefulness of exercise as a treatment intervention with inpatient problem drinkers. The programme consisted of aerobic exercise walking and jogging three times a week for four weeks (see table 5). Results indicated lowered anxiety and depression scores but no improvement in fitness or self concept. Twenty seven

subjects (mean age of thirty-five), nine of whom were women, completed the exercise programme. A control group of twenty-six subjects (mean age of thirty-nine), seven of whom were women had pre - and post measures taken at a time point prior to the recruitment to the study of the exercise group. The dependent measures comprised of estimated  $\text{VO}_2$  max. (Astrand and Rodahl, 1977), the Zung self-rating depression scale (Zung, 1965); the Speilberger state-trait anxiety inventory ( Speilberger, 1984); the Tennessee self-concept scale (Fitts, 1965).

The evidence from this study indicates that exercise is a useful component of an inpatient alcohol programme in reducing anxiety and depression and the authors suggest that on discharge these patients will cope better with life-stresses. There is no follow-up data to support this latter statement and there is no data on abstinence rates post-discharge. This study attempted to address some of the methodological weaknesses evident in the earlier studies and it did this by combining a well designed exercise programme to the examination of a number of psychological variables. However the control group for this study was taken at a different point in time, prior to the recruitment to the exercise programme. This may have reduced the internal validity of the study. There was also no attempt to cope with experimental bias or the peripheral effects of time with the therapist (Hughes, 1984; Simons et al., 1985). Like the study by Sinyor et al. (1982) the exercise programme followed the guidelines laid down by the American College of Sports Medicine (1980). The authors suggest that a four week duration of the exercise programme may have been too short to allow changes in submaximal aerobic fitness. Alternatively a higher intensity of seventy to eighty-five percent of maximum heart rate during exercise may be required to achieve increased fitness in this short time-scale.

All of these studies with clinical populations with the exception of the study by Gary and Guthrie (1972) are quasi-experimental designed studies. They either have no control group or they are compared to a non-equivalent group in a control condition. Alternative explanations such as local history, selection bias, statistical regression and testing effects, remain plausible with this type of design ( Cook and Campbell, 1979). The inability of quasi-experimental studies to rule out a number of alternative interpretations means that they are unable to permit strong causal inferences and at best are useful for suggesting that this area is of interest for further research. The

studies were undertaken with hospital inpatients and hence may present problems of external validity. That is the findings from these studies may only apply to inpatient populations of problem drinkers and similar findings may not be found with problem drinkers attending rehabilitation programmes as outpatients. The studies do include reports from a number of different cultural and social class backgrounds and this is a strength in external validity.

In an attempt to address some of the design issues inherent in earlier studies, and to determine if non-aerobic exercise had similar benefits to aerobic exercise with this clinical population, a randomised controlled study was carried out by the current author (Donaghy et al., 1991). This study investigated the effects of either 30 minutes of aerobic or non-aerobic exercise undertaken three times a week for eight weeks, with problem drinkers attending an out-patient alcohol treatment programme. The study was a randomised three group design with pre- and post- measures of physical fitness and psychological status taken at the beginning and end of an 8 week programme of exercise. Forty-five new male referrals to an alcohol treatment programme at Dykebar hospital in Scotland who gave informed consent to participate in the study, were randomly assigned to one of three groups. Thirteen males completed the aerobic activity, twelve males the non-aerobic weight training programme, with a further twelve males completing the control group which consisted of gentle stretching and breathing exercises. The aerobic and non-aerobic exercise programmes followed the guidelines laid down by the American College of Sports Medicine (1980).

The dependent measures comprised of the following: estimated  $VO_2$  max.(Astrand and Rodahl, 1977); Beck Depression Inventory (Beck et al., 1979); Leeds Anxiety and Depression Scale (Snaith et al., 1976); flexibility (Wells and Dillon, 1952); abdominal endurance (Glasgow University); Short-form Alcohol Dependence Data Questionnaire (Raistrick et al., 1983).

The strength of this study was its design, the limitation was the small sample size. Power in such a multivariate design with small samples and large variances for some variables is inevitably poor (Hays, 1973). The power to detect a 0.5 standard deviation of change with the independent t-tests was calculated to be only 0.42. To

avoid making a type II error the power to detect within group differences with dependent t-tests was explored and found to be 0.79. Within group analyses indicated that levels of anxiety and depression were significantly lowered for both the aerobic group, and the non-aerobic group, but not for the placebo control. Strength as measured by abdominal muscle endurance significantly improved in both the aerobic group, and the non-aerobic group, but not in the placebo control. Only the aerobic group demonstrated within group improvement in estimated  $\text{VO}_2$  max. Both the aerobic and the placebo control groups demonstrated within group improvement in flexibility. None of the groups showed a change in heart rate, weight or blood pressure.

The lowered anxiety and depression noted for both the aerobic exercise group and the non-aerobic weight training group are similar to the findings of studies undertaken by Martinsen (1989a; 1989b) with hospital inpatients with clinical depression. The results of this study like Martinsens' found within group differences for both types of exercise undertaken. Previous studies with problem drinkers had established that participation in aerobic exercise had lowered anxiety and depression (Frankel and Murphy, 1974; Palmer et al., 1988). The effects of non-aerobic exercise with this clinical population had not formerly been investigated. The findings of this study would suggest that non-aerobic exercise has a similar effect to aerobic exercise in reducing anxiety and depression this supports the work of both Doyne et al. (1987) and Martinsen (1989a) undertaken with clinical populations with depression.

Physiological improvements are limited to muscle endurance with non-aerobic exercise. For physical fitness and gains in estimated  $\text{VO}_2$  max. a programme of exercise featuring aerobic work is required. Unlike Palmer et al. (1988) who was unable to demonstrate any significant change in estimated  $\text{VO}_2$  max. The frequency, duration and intensity of the exercise programme in this study, was shown to be effective with the aerobic group increasing aerobic fitness. Sinyor et al. (1982) had previously provided evidence that problem drinkers participating in an aerobic graded exercise programme show adaptations similar to the normal population, this study supports these findings.



The limitations of the Donaghy et al. (1991) study, small sample size and low statistical power and the failure to find between group differences, means that the effects of undertaking an exercise programme with this clinical population still remain inconclusive. This led to further work by the author, using the power analysis to estimate the sample size required, to enable between group differences to be explored. A multi-site study was planned and the methodology and results of this study are reported and discussed in this thesis.

### **2.3.7 Contribution to current body of knowledge**

The research to date provides limited support to indicate that the inclusion of exercise in the treatment of problem drinkers will improve fitness, self esteem, lower depression and anxiety, and increase abstinence. Exercise intervention is of particular relevance to problem drinkers who are at increased risk of developing many physical illnesses (Edwards, 1982) and as a population generally have poor physical fitness (Palmer et al., 1988) and high levels of depression (Davidson and Ritson, 1993). Problem drinkers have a higher incidence of fractures due to the negative effect of ethanol alcohol on bone mass (Diamond et al., 1989; Rico, 1990; Jonsson et al., 1993) and higher incidence of musculo-skeletal problems exacerbated by myopathy and reduction of type II muscle tissue (Preedy and Peters, 1990). The benefits of regular exercise that becomes part of a lifestyle change has the potential to improve mood and stop the progression of these physical changes and in the case of bone and muscle tissue the potential to reverse these changes and to minimise their impact on health. The current research also indicates that by including aerobic exercise regimens within rehabilitation programmes may increase the likelihood of problem drinkers maintaining abstinence.

This proposed link between exercise and abstinence is extremely important in the treatment of a clinical population where the long term outcomes from treatment programmes are generally poor. The Rand report indicated that as many as ninety three percent of problem drinkers returned to drinking within four years of participating in a programme (Polich et al., 1980). The Scottish Health Statistics (1993) also indicate a high number of returnees to treatment programmes.

The rationale for including exercise within treatment programmes for the physical and psychological benefits is strengthened when the evidence from clinical populations of problem drinkers is presented alongside the evidence from other clinical populations (e.g. depression, cardiac rehabilitation). The studies in unipolar depression have been well designed and provide evidence that exercise is effective in lowering levels of depression (Martinsen and Stephens, 1994). Moderate to vigorous exercise has been shown to result in considerable health benefits (Bouchard et al., 1990). The theoretical arguments for its inclusion can be linked to theories of self efficacy (Bandura, 1977), stages of change theory (Prochaska and Diclemente, 1992) and to developing coping strategies. The development of strategies during treatment that can be incorporated into longer term lifestyle strategies for behavioural change are currently seen as essential for maintaining abstinence or controlled drinking (Saunders, 1994).

Exercise has the potential to be a cost effective coping strategy in the treatment of problem drinking. It offers the possibility of a strategy that can facilitate confidence in both the taking up and continuing with alternative healthy lifestyle behaviours. Exercise has the potential to include family members, friends in the activity and improved fitness enables other areas of physical activity in relation to sport and leisure to be accessible. The needs of problem drinkers can not, in the long term, be fully met by health care professionals. It is essential that simple strategies, which can be introduced in a short treatment programme, can be adopted by patients to help them cope more effectively with mental health and behavioural problems. There is sufficient evidence to suggest that exercise is one such strategy for problem drinkers.

### **2.3.8 Summary of evidence**

The empirical evidence from studies undertaken with clinical populations of problem drinkers to support the beneficial effects of exercise in treatment is weak. There is a great need for well-designed research. The methodological weaknesses in the current literature with clinical populations of problem drinkers suggests that the current findings should be interpreted with caution. There is some evidence to support the use of exercise for the following: to lower depression and anxiety (Frankel and Murphy, 1974; Palmer et al., 1988; Donaghy et al., 1991); to improve physical fitness

(Gary and Guthrie, 1972; Tsukue and Shohoji, 1981; Palmer et al., 1988; Donaghy et al., 1991); to improve abstinence (Sinyor et al., 1982); and to improve self esteem (Gary and Guthrie, 1972). There is some evidence to suggest that non-aerobic exercise is as beneficial as aerobic exercise in lowering anxiety and depression (Donaghy et al., 1991). No definite conclusions can be drawn from these studies with only limited evidence to suggest short term benefits for problem drinkers. At present there is no support for long-term benefits of either fitness or mental health benefits from exercise for this clinical population.

The common methodological problems associated with the research taken from clinical populations of problem drinkers in relation to exercise includes the following:

- lack of consistency in design of exercise programmes, - for example it is difficult to compare the outcomes from a 10 month programme of Basketball (Tsukue and Shohoji, 1981), with a 4 week programme of walking or jogging (Palmer et al., 1988).
- lack of consistency in choice of outcome measures making comparison across studies difficult; - for example inconsistencies in psychological and physiological measures across all studies;
- failure to ensure that patients in both experimental and control conditions receive comparable attention and time intensive contact with the therapist, - only Donaghy et al. (1991) controlled for this;
- failure to follow patients for adequate lengths of time post-treatment; - only Sinyor et al. (1982) has included follow-up post treatment measures;
- failure to provide for adequate multidimensional treatment outcome measures highlighting a full range of patient behaviour; - Sinyor (1982) is the only one to include measure of drinking behaviour but does not include any psychological measures;
- failure to provide theoretical underpinning of studies making it difficult to forecast what theories may predict results obtained, - the links between what was found

and the relationship with psychological theories is poorly discussed in all of the studies;

- failure to report critically the results of the research, - this is a weakness evidenced in the majority of the studies reported, for example there is little or no discussion relating to limitations of single group study, and quasi-experimental designs when discussing the clinical relevance of the findings.

### **2.3.9 Gaps in the current literature**

At the moment the empirical basis is insufficient to provide a basis for the design of individualised treatment plans. There is insufficient evidence with regard to the following: the short and long term benefits of exercise on mood and fitness; the role of exercise with regard to relapse prevention and maintaining abstinence and controlled drinking; the continued use of exercise to promote self-esteem and life-style change.

To gain further insight and understanding of the mechanisms mediating the beneficial effects of exercise the patients' subjective experience of altered fitness should be explored alongside objective measures of fitness. This should include patients' perceptions of changes in body image, body condition, strength, self-esteem and experiences of mastery.

There is a need to determine the effectiveness of programmes within the current treatment regimens of in-patient and out-patient alcohol programmes. Most of these programmes are short intensive programmes and consideration has to be given to what can be achieved within this time- frame and what can be achieved from continuing with a longer home-based programme.

There is a need to:

- undertake randomised controlled studies that include clinical populations attending out-patient programmes as well as in-patient programmes;

- establish the physiological and psychological effects of exercise within short time frames as most treatment programmes are currently of three to four weeks duration;
- undertake follow-up studies to establish whether fitness and psychological gains are maintained over time;
- provide further evidence of a relationship between exercise and improved mood states in rehabilitating problem drinkers;
- provide further evidence of the link between exercise and improved aerobic fitness and strength, establishing minimum time required for improved fitness;
- to investigate the patients' perceptions of body image, condition, strength and self esteem;
- to provide further evidence of the link between exercise programmes and increased abstinence or controlled drinking;
- to investigate the relationship between self-esteem, fitness and abstinence or controlled drinking.

### **2.3.10 Aims of the Study**

The aims of the study were to build upon the findings of the earlier work undertaken by the author, to evaluate the short and long term effectiveness of a physical exercise programme as an adjunct to treatment with problem drinkers. Taking into account the current length of time of in-patient and out-patient treatment programmes and the needs identified above with answers being sought to the following questions:

1. Does the inclusion of a three week exercise programme in an abstinence rehabilitation programme lower levels of anxiety and depression?
2. Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme enhance levels of physical self-worth?

3. Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme enhance patients' subjective experience of body attractiveness, physical condition, and physical strength?
4. Does the inclusion of a three-week exercise programme in an abstinence rehabilitation programme, over and above improvements related to withdrawal from alcohol, improve the physiological parameters of aerobic capacity, strength and flexibility?
5. Can the effects of an exercise programme be linked to maintaining abstinence levels up to four months post discharge?
6. Does participation in a three-week exercise programme followed by a twelve week home-based programme increase levels of physical activity during the four months post discharge period?

Chapter three reports on the methodology of a multi-site randomised controlled study that was undertaken at four alcohol treatment centres in Scotland.

## CHAPTER 3

### METHODOLOGY

This chapter reports on the methodology of a study in which the effects of undertaking a three week supervised exercise programme followed by a twelve week home based exercise programme, were investigated with adults in an abstinence treatment programme within four alcohol problem clinics in Scotland. The study was a two group randomised experimental design with physiological and psychological variables being measured pre and post intervention and then at time points from entry to the programme at two months and five months. The time points at which data were gathered are reported as follows: pre measures are reported as the baseline measures; post measures from the three week intervention are referred to as the 1 month time point; data gathered at the one month follow-up is referred to as the 2 month time point; data gathered at the four month follow-up as the 5 month time point.

Sample size calculations were made from an earlier study (Donaghy et al., 1991) in order to indicate the sample size required to enable between group differences to be explored. A power calculation was undertaken and indicated a sample size of 100 subjects was required to allow an 80% power to detect statistical differences in Beck Depression Inventory (BDI) and estimated  $VO_2$  max. This calculation allows for a 20% drop-out rate and is based on a within subjects change of 6.6 BDI units and 2.65 in estimated  $VO_2$  max. (Calculations were based on advice received from the Medical Statistics Unit Edinburgh University). The calculation was crucial to inform decisions regarding the design of the study, whether to have a two group randomised design or a three group

randomised design. It provided a rationale for having a multi-site clinical trial to enable the required numbers to be recruited to the study within a reasonable time scale. The following points were considered in relation to the design of the study.

The initial study (Donaghy et al., 1991) had included two treatment groups and a control group and had taken eighteen months to recruit 45 subjects. There was no follow-up appointments in the study which would have extended the data gathering period by a further six months. To inform decisions regarding time scale and number of sites required, alcohol problem treatment clinics within a 100 mile radius of Edinburgh were contacted and information gathered on numbers attending treatment programmes within the previous year. It was also necessary to consider the structural changes within the National Health Service (NHS) at this time (1993). Many hospitals were moving to Trust status with changes in internal management. The future of current treatment programmes were undergoing change, with three or four week alcohol treatment programmes now becoming the norm. Discussions with Psychiatric Consultants and Physiotherapists from these treatment programmes indicated that a research project with a programme of intervention lasting one year, followed by a further six months of follow-up data gathering, would fit better with their current planning strategies. Due to the speed and nature of changes within the NHS at this time they felt unable to commit themselves to a research project with a longer time scale.

Based on this information it was decided that to ensure an adequate sample size within a reasonable time scale the study would include one treatment group and a control group and would recruit subjects from four alcohol problem treatment clinics. It was considered that the earlier study (Donaghy et al., 1991) had provided some evidence that both aerobic and non-aerobic exercise was beneficial in treatment and that a comparison between the two types of exercise would not be explored further in this study. A decision was made to have a programme of exercises, for the intervention treatment group, that included aerobic endurance, muscular strength and flexibility which followed the American College of Sports Medicine guidelines on the frequency, duration and intensity of exercise required for developing and maintaining



both aerobic fitness and muscular strength and endurance (American College of Sports Medicine, 1990).

### 3.1 SUBJECTS

The sample of subjects (n=165) recruited to the study from the four sites exceeded initial expectations of 120, calculated from the power analysis, and has strengthened the study. Of those recruited, 158 commenced the intervention programme with a further 41 dropping out of the unit or leaving the study during the three week intervention stage. The age and gender of the subjects recruited to the study is indicated in table 6.

<b>Sex</b>	<b>n =</b>	<b>Mean</b>	<b>SD</b>	<b>Range Min</b>	<b>Range Max</b>
<b>Female</b>	<b>39</b>	<b>41</b>	<b>7.77</b>	<b>30</b>	<b>58</b>
<b>Males</b>	<b>126</b>	<b>41</b>	<b>8.67</b>	<b>21</b>	<b>58</b>

**Table 6 - Age of subjects by Gender**

The subjects were problem drinkers who were patients attending an abstinence rehabilitation programme at one of the following four sites:

<b>Hospital</b>	<b>Mode of programme attendance</b>
Ailsa Hospital, Ayrshire	three week in-patient programme
Royal Edinburgh Hospital	three week in-patient programme
Gartnavel Royal, Glasgow	four week out-patient programme
Cameron House, Dumfries	non time framed out-patient programme.

The intervention physiotherapy programme was the same at each site and was carried out as stated in the procedure. The programme was designed to take account of the different service deliveries indicated above.

Baseline values were gathered by the author (researcher) for all subjects to ensure group equivalence. They were then randomly assigned by the physiotherapist, using

an order random list to either the intervention group or to the placebo control. The intervention group (group A) (n=46 male; n=15 female) completed a programme of exercises designed to increase aerobic capacity and strength (American College of Sports Medicine, 1980). The placebo control group (n= 43 male; n=13 female) completed an exercise programme of gentle stretching and breathing exercises designed not to increase aerobic capacity and strength. The number of subjects dropping out of the study by gender from baseline to the post intervention stages are illustrated in table 7'.

Time Points	Exercise Group A				Control Group B			
	Male	Female	Drop outs	Total in study	Male	Female	Drop outs	Total in study
Baseline	63	20	3	80	63	19	4	78
1	46	15	19	61	43	13	22	56
2	28	9	24	37	25	8	23	33
5	13	9	15	22	15	6	12	21

**Table 7** - Number of subjects by gender at baseline, 1 month, 2 month and 5 month

Table 7 indicates a drop out rate of 26% at one month. The drop out rates at two months and five months were 30% and 17% respectively. The table indicates a similar number of drop-outs overall from both groups.

At two months, 70 subjects attended for recall. Of these 53 were male (n=28 group A; n=25 group B) and 17 were female (n=9 group A; n=8 group B). At five months, 43 subjects attended for recall. Of these 28 were male (n=13 group A; n=15 group B) and 15 were female (n=9 group A; n=6 group B).

### **3.1.1 Ethical Permission**

Ethical permission for the study was sought and granted from the ethical research committees of the four Health Boards with responsibility for monitoring research for the above named hospitals participating in the study, namely: Ayrshire and Arran; Lothian and Borders; Dumfries and Galloway; Greater Glasgow. New patients, on

admission to the alcohol rehabilitation programmes indicated above, were informed of the study and those interested in participating were issued with information sheets (appendix 1). Forty-eight hours were given prior to informed consent being sought during which time patients had the opportunity to discuss the study with a medical physician within the alcohol problem clinic or their General Practitioner, and ask questions of the physiotherapist participating in the research and the main researcher. Patients who wished to participate in the study then completed the informed consent forms (appendix 2). The following exclusion criteria applied to subjects who gave informed consent to participate:

- any of the following medical conditions: advanced osteoarthritis; severe chronic obstructive airways disease; recent myocardial infarct (last 6 weeks) or any other contraindication to participate in exercise from medical examination or medical records;
- any patient aged sixty and over;
- any patient with a current history of drug abuse other than alcohol.

Subjects were informed in the information sheet and again in the consent form about withdrawal from the study. They were also informed that they could withdraw from their allocated group and join the other group, in which case they would be considered to have withdrawn from the study, and no further data would be gathered from them for inclusion in the study. Two subjects randomised to the placebo control group indicated their desire to withdraw and participate in the exercise group. They were allowed to do this, successfully completing the programme but their data gathered was excluded from the analysis.

The subjects were randomly assigned by the physiotherapist at each of the four participating sites, using a random order list, to either the exercise groups or to the placebo control group. Only subjects who completed the three week intervention programme and completed the pre-and post measures are included in the analysis at one month. Data was also gathered at time points from entry to the programme at two months and five months, although the number of returnees to the study for follow-up measures, diminished at each time point as indicated in table 7.

### 3.2. DEPENDENT VARIABLES

The dependent variables were as follows:

- estimated  $\text{VO}_2$  max., aerobic fitness (Astrand and Rodahl, 1977);
- standardised sit and reach test to measure flexibility (Wells and Dillon, 1952);
- standardised sit-up test to measure abdominal endurance (Glasgow University);
- 7 day recall of physical activity (Blair, 1984);
- the Beck Depression Inventory (Beck et al., 1979*b*);
- the Zung Rating Inventory for Anxiety Disorders (Zung, 1971);
- the Physical Self-Perception Profile (Fox and Corbin, 1989);
- the Short-form Alcohol Dependence Data Questionnaire (Raistrick et al., 1983);
- 7 day recall of drinking behaviour (Sobell et al., 1988);
- Carbohydrate-Deficient Transferrin blood analysis to detect heavy alcohol consumption.

### 3.3 APPARATUS

A number of physiological measures were taken to measure baseline values and change over time. These required some specific items of equipment such as a cycle ergometer Monark model 814 E and Polar sports tester heart rate monitor. The psychological measures and measure of alcohol dependence were taken using previously validated and readily available questionnaires (Beck et al., 1979*b*; Zung, 1971; Fox and Corbin, 1989; Raistrick et al., 1983; Sobell et al., 1988). All physiological measures taken followed previously identified procedures (Astrand and Rodahl, 1977; Wells and Dillon, 1952; Blair, 1984). The rationale for the use of all of the above measures and issues regarding their reliability, validity, and where appropriate the calibration of equipment are discussed in this section.

It is necessary to consider what we mean by physical fitness, flexibility and muscle strength to understand the rationale for the choice of the physiological measures undertaken in this study as this has not previously been discussed in the literature review.

### **3.3.1 Measuring Aerobic Fitness.**

The measurement of physical fitness, and the subsequent evaluations from these tests, is useful not only for training strategies for the athlete and sports person, but also for people who wish to undertake and monitor a progressive exercise programme for health and leisure (Skinner, 1987). The specific needs of the disease limited person may focus fitness testing to one or two areas only, such as cardiovascular fitness and body composition (Haskell et al., 1992). This is often monitored under close medical supervision. Exercise testing will help exclude contraindications to exercise training and can be used to establish guidelines for safe exercise prescription and participation. Skinner (1987) emphasises the importance of establishing a fitness profile which can then be used to teach people about the benefits and risks of exercise. This information can then be used to form the basis of the exercise programme taking into account the interests and preferences of the individual. Physical fitness measures are used primarily in this study as dependent variables, in an attempt to obtain valid and reliable outcome measures.

Physical fitness has been defined by Blair et al. (1992) as a set of attributes that people have or achieve that relates to the ability to perform physical activity. Physical activity is any bodily movement that results in energy expenditure (Caspersen et al., 1985), this may be occupational, sports, conditioning, household or other activities (Allied Dunbar National Fitness Survey 1992). Physical activity and physical fitness are related, it is well documented that the effects of regular physical activity lead to higher levels of physical fitness.

The American College of Sports Medicine (1990) has defined health related fitness as the components of fitness that can prevent disease, and increase the ability to perform moderate to vigorous levels of physical activity without undue fatigue. This includes cardiorespiratory endurance, muscular endurance, muscular strength, flexibility and body composition. Bouchard et al. (1990) go further than this defining physical fitness as a functional integration of all of the body systems influenced by physical activity particularly; cardiovascular, respiratory, musculo-skeletal, metabolic-endocrine, neuropsychological, haematological, and gastrointestinal. Falls (1980)

takes a more holistic perspective in defining health related fitness as those aspects of physiological and psychological functioning which are believed to offer the individual some protection against degenerative type diseases such as coronary heart disease, obesity, and various musculo-skeletal disorders.

The physical fitness component that has most often been studied for an association to health is aerobic power (Blair et al., 1992). Cardio-respiratory fitness is often reported as the most important component in the health related factor (Haskell et al., 1992; Morris et al., 1990; Oldridge et al., 1988; McLeod et al., 1987). The reason for this being that the capacity to perform heavy prolonged muscular work is dependent on the supply of oxygen to the working muscles which is limited by the combined capacity of the respiratory and cardiovascular systems to transport oxygen. Improved cardiovascular function is an important factor in preventing circulatory disease or reducing its effects (Falls, 1980). The fitter the person the higher the physical working capacity (Blair et al., 1992).

In order to estimate cardio-respiratory effectiveness, tests of aerobic power must be undertaken. Aerobic power is the maximum rate at which one can consume oxygen.  $\text{VO}_2$  max. has been defined as a situation where a person physically working at a very high rate fails to further increase the rate of directly measured  $\text{VO}_2$  despite increases in power output. This plateau value of  $\text{VO}_2$  is termed  $\text{VO}_2$  max. (Wagner, 1991). The Douglas bag method is the most accurate method of determining  $\text{VO}_2$  max. This involves the direct measurement of oxygen uptake using gas analysis equipment while the subject exercises on a treadmill or cycle ergometer to exhaustion. A possible source of error in determining  $\text{VO}_2$  max. is that a true maximal effort may not be obtained (Hammond and Froelicher, 1984). There are a number of further limitations with this method: subject motivation; potential cardiac risk; the requirement in time; the capital costs of equipment and running cost of precise gas analysis. The laboratory setting and necessity for trained personnel required for this test is also a limitation to its general usage. It is also not suitable for testing large groups.

The measurement of  $\text{VO}_2$  max. is undertaken in the laboratory using cycle ergometry or treadmill test. The on-line collection and computerised gas analysis can give an

immediate record of  $\text{VO}_2$  max. It is beneficial to collect samples every 30 seconds rather than each minute, as this leads to greater accuracy in identifying peak power output. The treadmill test normally allows for a 5% - 10% higher  $\text{VO}_2$  max. than the cycle ergometer test, this can be explained by the larger muscle mass that is involved in this test (Astrand and Rodahl, 1986). The exception to this is with trained cyclists who perform at higher values on the cycle ergometer, this being sport specific. The use of cycle ergometry in preference to the treadmill has advantages for evaluating people who are not able to maintain their gait because of obesity, poor co-ordination or other factors. Hand cranking  $\text{VO}_2$  max. may be used to measure  $\text{VO}_2$  max. where there is lower limb deficit. The development of friction braked and isokinetic type systems in cycle ergometers has increased the sensitivity to which the performance during maximal exercise can be monitored (Winter, 1991).

### **3.3.1.1 Estimated Aerobic Fitness by Prediction of Maximal Oxygen Uptake.**

In clinical studies such as this study, the limitations of the method and the cost of obtaining  $\text{VO}_2$  max. may preclude the use of this test. This has led to the development of a number of sub maximal tests to predict  $\text{VO}_2$  from oxygen consumption and / or heart rate at one or more submaximal workloads and these plus a range of other variables such as age, gender, and weight have been included in the equation. These tests are simpler to administer and do not require expensive equipment.

The Astrand and Rhyning Nomogram (1977) is one method used to predict  $\text{VO}_2$  max. In the Astrand Rhyning test, the assumption is made that there is a linear relationship between work intensity, heart rate and oxygen uptake during exercise. It is possible to predict the  $\text{VO}_2$  max. of an individual from one steady state heart rate at a known work rate. Using a steady state approach serves to standardise conditions, this is necessary for any repeat movements. The submaximal heart rate can be extrapolated to the individuals maximum heart rate to give  $\text{VO}_2$  max. If the subject's maximal heart rate is unknown an estimation can be made from the following formula

Estimated max. HR=  $210 - (0.65 \times \text{age})$

This formula is only accurate to + or - 10% (Wilmore, 1977). Overall the submax prediction of  $\text{VO}_2$  is clearly less accurate than  $\text{VO}_2$  max.

Washburn and Montoye (1984) compared the three most popular methods of estimating  $\text{VO}_2$  max.; Astrand Rhythmic nomogram, the extrapolation method described by Maritz et al. (1961) and the procedure of Margaria et al. (1965). The Astrand-Rhythmic nomogram tended to over predict  $\text{VO}_2$  max. while the other two methods under predicted. The correlation between predicted  $\text{VO}_2$  max. using the Astrand-Rhythmic nomogram in a longitudinal six week study ranged from 0.91 to 0.61 (Rogers et al., 1993). The highest correlation values occurred prior to exercise training and after the third and sixth week. The lowest values were recorded during the first two weeks of training.

The current view is that predictive tests provide a fairly accurate estimate of the mean  $\text{VO}_2$  max. for a group and are a valuable training guide to determine whether or not a training programme is effective (Astrand and Rodahl, 1986). They are a less reliable measure if used to compare one individual to another.

### **3.3.1.2 Measurement Modality**

A wide range of equipment may be used to achieve the desired workload in direct and predictive tests of  $\text{VO}_2$  max. The cycle ergometer was chosen for this study as for very unfit individuals it can be set at lower workloads. The ergometer cycle also supports the body mass and requires a minimal period of familiarisation. Treadmill walking or running in comparison requires a longer period of familiarisation and may be difficult for patients who are unfit or who have poor co-ordination. Poor physical status and fitness have been noted in problem drinkers (Palmer et al., 1988). This combined with other common clinical features such as peripheral neuropathy (Edwards, 1982), which may result in impairment of co-ordination, support the rationale for selection of the cycle ergometer.

Astrand and Rodahl (1986) suggest that protocols that use a cycle ergometer produce  $\text{VO}_2$  max. values that are between 4% and 8% lower than treadmill values. This is thought to be due to the involvement of a larger muscle mass extracting more



oxygen, although trained cyclists can achieve similar values on the treadmill and cycle ergometer.

The following equipment was used in the measurement of estimated  $\text{VO}_2$  max. using the Astrand-Ryming nomogram: a Monark cycle ergometer model 814E. and Polar PE 2,000 Sports Tester for monitoring heart rate. The cycle ergometer was calibrated following the manufacturers instructions prior to every test being undertaken.

### **3.3.2 Measuring Flexibility - The Sit and Reach Test.**

The intervention exercise programme in the study included some exercises designed to increase flexibility, particularly in relation to the warm up and cool down parts of the exercise programme. A measure of flexibility as an outcome measure was therefore desirable. Flexibility refers to the degree to which a joint may move through its maximum possible range of motion. The determining factor in joint range of motion is the extensibility of the associated connective tissue (tendons and ligaments) around the joint. The relative importance of the soft tissues with respect to limiting flexibility is as follows, joint capsule 47%, muscle 41%, tendon 10%, skin 2% (Fox et al., 1989). Tests constructed to measure flexibility emphasise the ability to move or stretch the body or some part thereof as far as possible in various directions (Nick and Fleishman, 1960).

Static flexibility can be measured using a flexiometer or a sit and reach board. The Wells and Dillon (1952), sit and reach test has a coefficient correlation of 0.90 for measuring back and hamstrings flexibility. It is suggested that this is a valid and reliable test. However this has been challenged by Jackson and Langford (1989). The results of a study undertaken by them indicates that the test has a high validity as a measure of hamstring flexibility and only moderate validity as a measure of lower back flexibility. They question the validity of the test as a measure of lower back flexibility for the general population. There is no available research data that demonstrates that low back flexibility in either extension or flexion is directly related to normal back function. They recommend further investigation into developing a field test for assessing low back flexibility in terms of back extension.

Dynamic flexibility has been described as the ability to make repeated rapid flexing movements in which the resilience of the muscles in recovering from strain or distortion is crucial. It is much more difficult to measure this type of flexibility and to date it has been given only scant attention in the literature (Nick and Fleishman, 1960)

The criticism of Jackson and Langford were noted however for the purpose of this study a validated measure of static flexibility was desirable. The sit and reach board (Wells and Dillon, 1952) as a measure of hamstring flexibility and lower back flexibility, was thought to be the most appropriate reliable and validated test currently available. The sit and reach board was readily commercially available and standardised procedures for undertaking the measurement were previously established.

The following equipment was used to measure flexibility : a sit and reach board (Wells and Dillon, 1952) and a stopwatch. The sit and reach board does not require to be calibrated its use does require standardisation of positioning and procedure. This was undertaken during every test.

### **3.3.3 Muscular strength - measuring abdominal endurance**

Strength is often defined as the ability of a muscle or group of muscles to exert a force against some external resistance in one maximal effort (Fox et al., 1989). There are four basic types of muscular contraction: isotonic, isometric, isokinetic and eccentric, (Fox et al., 1989). The strength of muscle groups can be measured by dynamic tests that involve movement and static tests which involve isometric contraction. Dynamic tests may be done on Cybex equipment, bench press with free or machine weights and this is called the one repetition max. test. Static tests use a cable tensiometer or strain gauge with max. force being measured at joint angles. It has been suggested that from both a theoretical and practical viewpoint, isokinetic measurements and training programmes are mostly suited to increasing muscle strength (Fox et al., 1989).

Muscle endurance is said to be the ability of a muscle or muscle groups to perform repeated contractions against a submaximal load over a period of time (isotonic, isokinetic or eccentric) or a sustained contraction (isometric) (Fox et al., 1989). Endurance tests can be dynamic or relative load tests. Dynamic endurance tests require the subject to lift a set weight at a set cadence until they fatigue and can no longer maintain the pace. Relative load tests require the subject to lift a pre-determined percentage of their maximum strength, this is measured against time in sustaining this static force. It is generally accepted that muscular endurance is increased through training muscles that emphasise high repetitions and relatively low resistance (Fox et al., 1989) although Wilmore (1977) suggests that there is a high correlation between strength and absolute muscular endurance. It would appear that programmes designed to increase strength will also improve endurance the overload principle states that gains in strength and endurance are most pronounced when the muscle is exercised with resistance's above those normally encountered by the muscle (Hellebrant and Houtz, 1956).

There are other factors that influence muscle endurance these are local circulation and local muscular enzyme activity. To train specifically for local muscular endurance in addition to load, repetitions and sets, the system which supplies the energy required for movement should be considered. The body of evidence from the literature suggests that there is an increase in the total concentration of adenosine triphosphate (ATP) and creatine phosphate (CP) in skeletal muscle following endurance training (Karlsson et al., 1971). The oxidation of both fats and carbohydrates occurs as sources of fuel, during exercise. Matoba and Gollnick (1984) suggest that the increased use of fat during submaximal exercise appears to be more closely related to the elevations in the concentration of mitochondria in muscle than to changes in total body maximal oxygen uptake.

Abdominal endurance may be assessed by measuring the number of sit-ups which can be successfully executed in one minute. It is important to standardise the testing procedures for each subject. This test measures the abdominal (upper and lower rectus abdominus) the hip flexors (psoas and iliopsoas) and the external and internal

obliques. Test-retest reliability coefficients ranging from 0.68 to 0.94 have been reported for the flexed knee sit-up test (Pollock et al., 1984).

The decision to include exercises to improve muscular strength and endurance along with exercises to improve aerobic fitness within the intervention exercise programme was based on the perceived health related needs of problem drinkers. The multiple musculo-skeletal and other health problems evidenced from the research and summarised in chapter 2 section 2.3.7 would suggest that a programme of exercise designed to increase metabolic activity through both aerobic and muscle strength is desirable.

The rationale for inclusion of this test was that it required no specialised equipment, it had been previously validated and standardised procedures were clearly documented. The only equipment used to measure abdominal strength was a stopwatch.

#### **3.3.4 Measuring Physical Activity.**

The inclusion in this study of a home based exercise programme made it desirable to look at the levels of daily physical activity that subjects were participating in on entry to the programme and following discharge. The importance of incorporating exercise as a lifestyle change and to use it effectively as a coping strategy was of perceived importance to the study. Measuring physical activity by completing a 7 day review of exercise participation has been shown to have construct validity (Blair, 1984; Dishman and Steinhardt 1988) and has been used in previous studies (Loughlan, 1995).

A small scale study was undertaken by Loughlan and Mutrie (1996) to assess the reliability of the adapted form of the 7 day recall questionnaire. Analysis was undertaken with twenty-one questionnaires returned at each of the allocated time points. A two weekly interval separated the administration of the first and second questionnaires. The results suggests that questionnaires with a short time frame, such as the 7 day recall, re-administered after a short time period, measure a combination of short term stability of physical activity in addition to the questionnaire's reliability. The correlation coefficient between test and re-test at two

week interval was 0.757 showing a significant relationship (critical value = 0.665,  $p < 0.001$ ; 19 *df*).

There has been an unsuccessful attempt to validate the 7 day recall with aerobic power and body mass index (Loughlan and Mutrie, 1996). No association has been found between physical activity and estimated  $\text{VO}_2$  max. using the 7 day recall questionnaire. It has been suggested that the more moderate forms of physical activity that the 7 day recall questionnaire picks up do not contribute significantly to aerobic fitness. However, having evidence of time spent in moderate physical activity for the purpose of this study is useful, as it may support evidence for a changing lifestyle gathered from other areas of the study. The rationale for inclusion of this measure was that it was simple to complete and it gave some indication of the levels of time in physical activity.

### **3.3.5 The Beck Depression Inventory.**

The current Beck Depression Inventory (BDI), in its revised version (Beck et al., 1979b), is a 21 item instrument designed to assess the severity of depression in adolescents and adults. In psychiatry and clinical psychology the BDI since its inception (Beck et al., 1961) has become one of the most widely used and accepted instruments for assessing depression in both clinical and nonclinical populations. It has been extensively reviewed for both its validity and reliability and application with different clinical and normal populations (Snaith and Taylor, 1985; Lambert et al., 1986). It was developed initially with samples of 226 and 183 depressed patients who were attending for psychotherapy.

#### **3.3.5.1 Reliability**

The psychometric properties were studied extensively across six normative-outpatient samples, gathered over a period of several years, at the Centre for Cognitive Therapy at the University of Pennsylvania Medical School. These samples included outpatient admissions with different DSM III diagnosis including the following: single and recurrent major depressive disorders (Steer et al., 1986; 1987); heroin addicts (Emery et al., 1981); alcoholics (Steer et al., 1983; 1985); dysthymic disorders (Steer et al., 1986); and a mixed psychiatric sample (Beck and Steer, 1984). Internal

consistency estimates based upon Cronbach's coefficient alpha for each of the six samples range from 0.79 to 0.90 and are consistent with mean coefficient alphas reported by Beck et al. (1988) of 0.86 for the BDI in a meta-analysis with nine psychiatric samples and 0.81 for fifteen nonpsychiatric samples. It can be concluded that the revised BDI has high internal consistency for both clinical and nonclinical populations.

The usefulness of exploring test-retest stability has been questioned with respect to detecting changes in psychiatric patients. These patients are expected to show reductions in depression from both effects of therapeutic intervention and change over time. Beck et al. (1988) reviewed ten studies that had used pre-test and post-test assessments. They found that the range of Pearson product moment correlations between these administrations of the test for varying time intervals with psychiatric patients ranged from 0.48 to 0.86. In contrast the test-retest correlations for nine studies of nonpsychiatric population ranged from 0.60 to 0.90, suggesting that the nonpsychiatric population displayed more stable BDI scores than the psychiatric population.

### **3.3.5.2 Validity**

The BDI (Beck, 1979b) has been found to have content validity that is consistent with most of the criteria for affective disorders listed in the DSM III (Moran and Lambert, 1983). However the BDI revised version has been criticised for not including explicit items addressing psychomotor activity and agitation which are included in major depressive disorders DSM III (Moran and Lambert, 1983).

The BDI has been found in a number of studies to be able to discriminate between dysthymic and major depressive disorders (Steer et al., 1987), and general anxiety and major depressive disorders (Steer et al., 1986). Although this discrimination validity has been found the BDI was not designed for this purpose. There have been numerous studies on the construct validity of the BDI with different variables (Beck et al., 1988).

Concurrent validity has been demonstrated with Beck et al. (1988) presenting Pearson product -moment correlations between the revised BDI and selected concurrent measures of depression across a variety of studies. Meta-analyses found a mean correlation of 0.72 between clinical ratings of depression and the BDI for psychiatric patients, and a mean correlation of 0.60 between clinical ratings of depression and BDI scores for nonpsychiatric populations. This has been supported by Schaefer et al. (1985) who reported correlations among BDI, MMPI-D scale and Zung self-rating depression scale (Zung, 1965) in one hundred and one psychiatric inpatients and ninety-nine inpatient drug abusers. All of the correlations were greater than 0.55 for both groups.

Beck et al. (1988) found a mean correlation between the Hamilton rating scale for depression (Hamilton, 1960) and the BDI of 0.73 for five psychiatric samples. Edwards et al. (1984), and Lambert et al. (1986) concluded that the revised BDI is less over-reactive to changes in depression than the Hamilton rating scale for depression. It is therefore less likely to overestimate improvements in patients receiving therapy intervention or drug therapy, than the Hamilton rating scale for depression.

The revised BDI has been factor analysed with both clinical and nonclinical populations (Beck et al., 1988). It has been reported that the BDI represents one underlying syndrome of depression comprising three highly intercorrelated factors. These factors reflect cognitive-affective, performance, and somatic complaints (Clark et al., 1983). The revised BDI scores are not meaningfully related to sex and age.

The rationale for including this measure of depression was its ability to distinguish between subjects in the study who were asymptomatic, and those who had symptomatic depression at levels of severity varying from mild or moderate to severe. It is generally regarded to be a better measure of depression than similar scales such as the Zung (Hammen, 1980). It has been used in many research studies to examine baseline values and change over time and has been found to be reliable and valid as stated above.

The apparatus used to measure depression in this study was the Beck Depression Inventory Manual and the twenty-one item self administered questionnaires. This is available to registered users through the Psychological Corporation Harcourt Brace Jovanovich, Inc.

### **3.3.6 Zung Rating Inventory for Anxiety Disorders.**

There are numerous rating scales which attempt to assess anxiety, however not all of them record the presence of anxiety as a clinical disorder. They can be divided into assessment scales that are general and measure anxiety as a personality trait or current emotional feeling, for example the Spielberger State-Trait Anxiety Inventory (Spielberger, 1984), or scales which are specific and measure anxiety as a clinical entity. For the purpose of this study it was desirable to use an instrument that would indicate symptoms of anxiety and quantify them in a symptomatic way that is indicative of anxiety as a psychiatric disorder.

The Zung rating scale for anxiety was devised as a two-part instrument, consisting of a self-rating anxiety scale (SAS) which is self administered and the anxiety status inventory which is the clinician rated instrument (ASI). The ASI contains the diagnostic criteria for anxiety as a psychiatric disorder (five affective and fifteen somatic symptoms). The SAS is based on the same twenty diagnostic criteria as the clinician rated ASI. with some of the twenty items being worded symptomatically positive and others symptomatically negative. The Zung scales were validated with the Taylor Manifest Anxiety Scale (TMAS) which is a fifty item scale drawn from the MMPI (Taylor, 1953). Pearson product -moment correlations for all coefficients  $r$  calculated were statistically significant with  $p < 0.01$  in all instances. The correlation between the ASI and SAS was 0.66. and the correlation between the ASI and TMAS, and SAS and TMAS were 0.33 and 0.30 respectively. Correlation between the ASI and SAS scores for patients with diagnosis of anxiety disorder was 0.74. Zung (1971) reports that the two part instrument is useful in quantifying anxiety as a psychiatric disorder and the instrument can be used independently as either an interviewer rated inventory (ASI) or as a self rating anxiety scale (SAS). For the purpose of this study the instrument that was used was the Self- rating Anxiety



Scale. This scale and the instructions for its administration and scoring are described in the article by Zung (1971) published in *Psychosomatics*.

### **3.3.7 Measuring Physical Self-Worth - The Physical Self-Perception Profile.**

The importance of self-esteem as an indicator of emotional and mental well being has long been recognised in alcohol addiction, with feelings of worthlessness frequently accompanying problem drinking behaviour. Building upon elements of positive self regard is essential in treatment programmes for problem drinkers (Chick and Cantwell, 1994), with positive self regard being seen as an attribute of an effectively functioning person. There is often confusion in the terminology regarding self-esteem and self-concept with these two terms frequently used synonymously. For the purpose of this study self-esteem is defined as the evaluative element of the self, based on individuals' judgement of their own worth.

Prior to the 1980's there was a lack of theoretical direction underpinning much of the research in this area (Harter, 1985), with the available measurement techniques focusing on a unidimensional approach. Assessment inventories required subjects to rate themselves on a variety of personal qualities and abilities in a range of life settings. By totalling the scores of these items a score of self-esteem is obtained. The problem with this approach is that it ignores the complexity of each individuals' perception and interpretation of the importance of these elements. For example the much used Tennessee Self-Concept Scale (Fitts, 1965) has a physical subscale with items referring to physical appearance, skill and health all of which might elicit diverse responses. There is a risk that low and high scoring of individual items will cancel each other out thus masking important information. These scales are unable to identify relationships among the different facets of the physical self due to their unidimensionality.

Since the early 1980's there have been advances in the literature on this topic. Perceptions of the physical self have emerged as being important in self-esteem. During development into adulthood and maturity, stature, physical ability, and appearance are increasingly used as reference points of self identity between individuals and their peers (Harter, 1990). Fox and Corbin, (1989) suggest that this

physical identity becomes associated with choice of physical activity and health-related behaviours.

The Physical self-perception profile (PSPP) was developed by undertaking a complex sequence of pilot studies, instrumentation trials, and modifications. (Fox 1990). Most of the data gathered for the validation of the instrumentation were taken from a sample of 1,191 male and female students at Northern Illinois University and a college in Missouri. The students were mostly Caucasian, and the mean age of the students was nineteen years. The PSPP is based on a hierarchical model of self-perception with physical-self worth (PSW) being seen as a domain or subscale that explains much of the covariance among the four subdomain scores of perceived physical condition, strength, body attractiveness and sport competence and is said to mediate their relationship with global self-esteem (Fox and Corbin, 1989). Fox (1990) compares the items in the PSW subscale to feelings of pride, respect, and satisfaction with the physical self. The relationship between the PSW subscale and the other subdomains was confirmed in the validation process of the instrumentation. Multiple regression analysis revealed that the four subdomain subscale scores, depending on the sample, explain between 65% and 75% of the variance in physical self-worth and support the content validity of the four subdomains used in the PSPP. The authors provide further evidence from factor analysis of the PSPP subscales that suggests that the subscales are capable of measuring independent but related perception constructs within the physical domain.

Internal consistency was addressed for each of the subscales using Cronbach's Alpha (Cronbach, 1951). These were consistently high for both males and females with a range of 0.81 to 0.92. Contribution of items to internal consistency is indicated by the correlation of the item to scale total with a range between 0.5 and 0.7 (Fox, 1990).

The test -retest reliability correlation coefficients of the PSPP are stated by the authors to be in the range 0.74 to 0.89, indicating that responses were relatively stable over a two to three week period. These findings were based on

readministering the questionnaire to a sample of forty subjects after sixteen days and with a further sample of thirty-six subjects after twenty three days.

A limitation of the PSPP is that the psychometrics have been exclusively established with a young American college student population. However the use of the instrument is being encouraged in physical education with special populations and has been used successfully with an obese adult population (Fox et al., 1990 cited in Fox, 1990).

The instrument had not been available when an earlier study by the author (Donaghy et al., 1991) was undertaken and therefore content validity and reliability for a problem drinking population had not been established. The use of the instrument with an obese adult population with a mean age of 41 for females and 43 for males, where the data gathered supported construct validity of the instrument gave some confidence in selecting this instrument for this study. To gather sufficient data to confirm content validity of the PSPP for a problem drinking population would have been beyond the scope of this study. However it was important to pilot the questionnaire with a small sample of problem drinkers to ensure appropriateness of the questions for this population and to establish test-retest reliability.

A convenience sample of seven males was recruited from the out-patient alcohol problem clinic where the earlier study (Donaghy et al., 1991) had been conducted. The PSPP was administered and then readministered after a further twenty days. The results in table 8 show test-retest reliability correlation coefficients. These Spearman Rank Correlations give a range of .74 to .96 (see table 8) indicating that responses are stable for this small sample of problem drinkers over a three week period. This demonstrates preliminary test-retest reliability.

Subscale	21-day retest (n=7)
PSW	.96
SPORT	.81
CONDITION	.83
BODY	.74
STRENGTH	.94

**Table 8** PSPP test-retest reliability coefficients

Following this procedure subjects were interviewed by the researcher in an attempt to establish if there had been any difficulties in interpretation of questions, to check for ambiguities and to see if the subjects felt the questions had been appropriate and easily answered. A sample of the questions from the PSPP were selected and subjects were asked open ended questions in accordance with the manual (Fox, 1990). The questions related to themselves and what they had considered when they answered these questions. The analysis of the taped interviews and analysis of the questionnaires indicated that the questionnaires had been completed satisfactorily and that they presented no particular difficulty in interpretation for this clinical population. The content of the questionnaire appeared to be appropriate. Although content validity was not fully established there was some support to indicate content validity for this small sample of problem drinkers.

The Physical self-perception profile was selected for the purpose of this study as it focuses on the evaluative self-perceptions of self-esteem and self-perception components remain central to theories of physical self-efficacy (Ryckman et al., 1982) and self-confidence (Corbin, 1984). This may be a key concept relating to the theory of mastery and self efficacy. Physical self perceptions have been linked to the uptake and adherence to exercise programmes (Dishman, 1994). As such they may be important in adherence to exercise as a self monitoring coping strategy for relapse prevention and maintenance of changed behaviours related to drinking. The profile also has the advantage of being equally valid for both genders. It offers a more

comprehensive self-perception map for investigating the nature and direction of the self-perception and exercise participation relationship.

### **3.3.8 Measurement of Alcohol Dependence**

There are several questionnaires that can be used to estimate the presence or degree of severity of an alcohol problem. The Severity of Alcohol Dependence Questionnaire (SADQ), was developed by Stockwell et al. (1979) to measure withdrawal symptomology. It does not include items relevant to other aspects of drinking behaviour such as salience of drink seeking behaviour or subjective awareness of compulsion to drink. The focus on withdrawal symptoms means that the sensitivity of this questionnaire is directed at the moderate to severe end of the drinking repertoire and is of limited usefulness in measuring through the range of dependence (Raistrick et al., 1983).

In contrast, the Short-form Alcohol Dependence Data Questionnaire (SADD, Raistrick et al., 1983) measures the more subjective aspects of early alcohol dependence through to more severe levels of dependence. Raistrick et al. (1983) recommend that scores of one to nine be considered low dependence, ten to nineteen moderate dependence and twenty or more high dependence. Raistrick et al. (1983) highlight the importance of having a questionnaire that is sensitive to the whole range of alcohol dependence as well as a questionnaire that has the capacity to measure change over time. Internal reliability of the SADD was evidenced in two ways. A split half reliability was computed by correlating (Spearman) odd with even numbered questions with a result  $r = 0.87$ . The authors also provide further evidence of internal reliability in the form of a matrix of correlations between questions and with the total score computed for SADD. The correlation between the full questionnaire comprising of thirty-nine questions, the Alcohol Dependence Data (Raistrick et al., 1983) and the shorter fifteen item questionnaire of the SADD was highly significant ( $r = 0.92$ ).

For the purpose of this study the SADD was chosen as a questionnaire that would highlight any differences at baseline between the groups in regard to severity of dependence, across the full range of dependence, as well as having the ability to

measure change over time. The instrument that was used was the SADD the questions and scoring method is described in Raistrick et al. (1983).

### **3.3.9 Measurement of Drinking Behaviour and Alcohol Misuse**

One of the aims of this study is to look at the effects of exercise in relation to maintenance of controlled drinking or abstinence. The assessment of drinking behaviour has most often been undertaken by Quantity-Frequency (QF) methods (Polich et al., 1980) and the timeline (TL) method (Sobell et al., 1979; Saunders et al., 1982). The QF method requires individuals to characterise their drinking in terms of average or typical patterns. When this method is applied to research the patterns are homogenised into a few categories, with each of the categories aggregating subjects with widely varying patterns. This can be problematic as some individuals have inconsistent patterns of drinking (Sobell et al., 1988) and may not yield data on actual levels of consumption. In three studies the QF method has been found to obscure actual drinking patterns across populations of drinkers (Sobell et al., 1988; 1986; 1982).

#### **3.3.9.1 Timeline Method**

The TL method is an alternative procedure to QF for assessing recent drinking behaviour. This method requires individuals to provide estimates of their actual daily intake of alcohol over a specified time period (Sobell et al., 1988). Several studies have found generally good agreement between self report on drinking behaviour and collaterals' reports (Maistro et al., 1985; Sobell and Sobell, 1986; Zweben, 1986). Thus lending some support for the validity of this method. However the validity of self-report of alcohol consumption has been challenged when it has been investigated in more recent studies against laboratory bench markers (Schellenberg et al., 1989; Sillanaukee et al., 1992).

#### **3.3.9.2 Biochemical Markers CDT**

Changes in components of blood and serum are commonly found among problem drinkers. For example increased enzyme activities and increased metabolite

concentrations or red blood cell macrocytosis. These biochemical markers are indicative of excessive drinking and include the following: gamma glutamyl transferase (GGT); erythrocyte mean cellular volume (MCV); aspartate aminotransferase (ASAT); alanine aminotransferase (ALAT). The lack of sensitivity and specificity for bench markers such as these listed has been well documented (Bisson and Milford-Ward, 1994).

Recently the development of carbohydrate deficient transferrin (CDT) as a state marker has been noted to have particular potential with regard to specificity and sensitivity (Salmela et al., 1994; Kapur et al., 1989). The ion transporting protein transferrin consists of a polypeptide backbone to which several polysaccharide chains are linked. The polysaccharide chains are desialylated by alcohol consumption. This desialylated transferrin, carbohydrate deficient transferrin, was introduced as a biochemical state marker of heavy alcohol by Stibler, et al. (1979). Stibler et al. (1991) found the sensitivity of CDT for alcohol abuse to be 94% and the specificity to be 98%. Although the availability of this state marker is fairly recent in this country it has been used for several years in Sweden where CDT was discovered by Stibler and Kjellin (1976) in the cerebro-spinal fluid and serum of alcoholic subjects. The exact mechanism behind the carbohydrate deficiency of transferrin is not yet known, however the association between regular heavy drinking and increased CDT levels has been confirmed in several studies (Storey et al., 1987; Kapur et al., 1989; Xin et al., 1992; Stibler, 1991). Correlations between CDT and daily alcohol consumption have also been found (Stibler et al., 1986). Gjerde et al., (1988) suggested that CDT may be used for monitoring abstinence or reduced alcohol consumption. Elevated values of CDT have been found by Stibler et al. (1991) in problem drinkers with a consumption of  $\geq 60$  g / day for at least seven days. During abstinence the values decline with a  $t^{1/2}$  of  $15 \pm 5$  days and were normalised after on average  $12 \pm 5$  days. Females have higher normal values of CDT than males possibly due to asialo and minosialo transferrin (Rosman et al., 1995). Thus the cut off values to indicate higher than normal values of CDT are higher for females than males.

For the purpose of this study a 7 day recall of daily alcohol consumption using the TL method was gathered at the two month and five month recall. In addition coded

analysis of serum samples were gathered and analysed to detect carbohydrate deficient transferrin. A 7 day recall drinks diary was produced for use in the study (appendix 3). All the equipment for the collection of blood samples was provided by the central laboratory at the Royal Infirmary Glasgow. It consisted of vacueneedle, containers for serum, packaging, specific laboratory forms, labels and envelopes for postage. A commercially available double antibody kit CDTect<sup>®</sup> was used to detect changes in serum CDT at recall.

### **3.3.10 Taped Exercise Programmes**

The programme of aerobic and strength exercise was compiled according to the guidelines for prescription detailed in the American College of Sports Medicine (1980), taking account of the recommendations regarding frequency, duration and intensity of exercise in the position stand paper (American College of Sports Medicine, 1990). A thirty minute tape with appropriate rhythmical music and voice over with the exercise instructions was compiled at Glasgow University. A further tape with soft relaxation music and a voice over with instructions for trunk and limb stretching and breathing exercises was compiled for the placebo control group.

### **3.3.11 Twelve week home based exercise programme**

A booklet of progressive exercises comprising of illustrations of exercises, instructions, tables for setting goals and monitoring heart rate was compiled at Glasgow University. This booklet was further developed from one that had been previously used in a study with older adults (Mutrie et al., 1994). The booklet was personalised for the problem drinking population that participated in the study, and the exercises built on similar exercises that had been undertaken within the aerobic and strength exercise programme. The rationale for the inclusion of the twelve week home based exercise programme was to enable the problem drinker to continue to exercise independently at home following discharge from the rehabilitation programme.

The second follow-up was timed to occur one month after the home-based programme had been completed, reported as the 5 month time-point, to evaluate the



effects of the three week and home-based programme in the longer term on all variables. In addition, to evaluate whether exercise had facilitated lifestyle changes as evidence by maintenance of fitness, levels of physical activity and drinking behaviour.

The booklets were produced by Glasgow University with funding made available from the SHHD research grant. Booklets with general information on exercise and health given to the control group were supplied by the Health Education Board for Scotland.

### **3.4 DESIGN**

The study was a randomised experimental two group design consisting of a treatment exercise group and a placebo treatment group. Physiological and psychological variables were measured pre and post intervention at one month and then at time points from entry to the programme at two months and five months.

### **3.5 PROCEDURE**

The data gathering stage of the study was undertaken from December 1993 until July 1995. The results were analysed and a report submitted to the Chief Scientists Office in May 1996. The procedures including planning of the study followed the completion and initial dissemination of the results of an earlier study (Donaghy et al., 1991).

#### **3.5.1 Planning**

The planning in setting up the study was undertaken over an initial four month consultation phase with a further six months taken to secure the necessary funding. The medical consultants and superintendent physiotherapists of four alcohol problem clinics within a 100 mile radius of Edinburgh were contacted and informed of the findings of the initial study (Donaghy et al., 1991) and the intended multi-site project. All sites indicated an interest and follow-up meetings were arranged to discuss the proposal with consultants, physiotherapists and nursing staff at the alcohol problem

clinics. It was decided not to include the site where the initial study had been undertaken. The rationale for this was that the rehabilitation programmes now had exercise firmly established as a goal choice option in their treatment.

A link was established with a senior biochemist within a central laboratory who had experience in analysis of the CDT blood samples to be used in the study, which was a fairly new procedure at the time in the UK. The involvement of biochemists at each of the hospital sites to co-ordinate the blood samples was undertaken within the first month of the study.

### **3.5.2 Funding the project**

Funding for two years was obtained from The Health Services Research Committee, the Chief Scientists Office, Scottish Home and Health Department. This enabled the purchase of necessary equipment, the analysis of blood samples, travel costs for the researcher, staff costs funding the researcher part-time, and secretary part time, and small payment to cover expenses for returnees to the follow-up sessions.

### **3.5.3 Organisation of the multi-site study**

It was necessary to have specific procedures for each of the four sites that closely related to the working practices of that unit. These were established following consultation with personnel at each of the sites for an example of these procedures (appendix 4). All personnel including consultant physician, physiotherapists and nursing staff at the four sites were then familiarised with the procedures.

### **3.5.4 Procedure for randomisation of subjects**

Subjects who gave informed consent to participate, and who were not exempt by means of the exclusion criteria, were randomly assigned to one of two groups, by the physiotherapist, using a random order list to either aerobic and strength exercise (group A) or to the placebo control (group B). The questionnaires on depression, anxiety, physical self perceptions, physical activity and alcohol dependence were administered by the researcher, who was blind to the randomisation process.

Following this the researcher carried out the measures of physical fitness, strength and flexibility. These psychological and physiological measures were taken together in week one of the rehabilitation programme, repeated at the end of the week three or beginning of week four prior to discharge. These measures were again repeated at follow-up time points of two months and five months from entry to the programme.

### **3.5.5 Procedures relating to blood samples**

The inclusion of blood samples in the study is to detect harmful levels of alcohol and to triangulate self reported information on drinking behaviour at follow-up appointments. Strict procedures were followed in relation to the collection and handling of samples (appendix 5).

Consistency in procedures was maintained as follows: equipment for the collection of blood samples was supplied by the central laboratory and distributed by the researcher; the researcher was in attendance with the consultant physician when samples were gathered; the samples were taken by the researcher to be centrifuged at the local laboratory; the samples were then posted out and analysed centrally by a senior biochemist at Glasgow Royal Infirmary.

### **3.5.6 Procedures for exercise programmes**

The procedure for the exercise programme followed the guidelines detailed by the American College of Sports Medicine (1990). The physiotherapists participating in the study attended a workshop organised by the research team, prior to the start of the data gathering stage of the study, to go over the procedures of the study and to ensure congruence at all sites. Inter-rater reliability of testing procedures was not required as the researcher was responsible for the administration of all test procedures.

Physiotherapists were instructed in the delivery of the exercise and placebo control intervention. Both groups met twice a week with the physiotherapist for a 30 minute supervised exercise session over a period of three weeks. The aerobic and strength exercise group (group A) started with a five minute warm up and finished with a five

minute cool down. Maintaining continuous aerobic activity for at least twenty minutes at an average intensity of training of between 70 - 75% of maximum heart rate reserve. Subjects were instructed in taking their own pulse and at a specific time point during the exercise programme they monitored their pulse rate. A wall chart enabled a quick visual check to ensure the appropriate intensity was being attained. The placebo control group (group B), were instructed in a programme which included some gentle stretching exercises of trunk and limbs, and breathing exercises which lasted no longer than thirty minutes. Inter-rater reliability of the delivery of the intervention exercise class and placebo control class was established by the use of taped music and instructions for both groups. Written instructions for both exercise programmes were provided for all physiotherapists.

The physiotherapist demonstrated the exercises, visually and verbally reinforcing the taped instruction during every session. In addition group A was further instructed by the physiotherapist throughout the programme on progression of exercises. Where two physiotherapists at one site were involved in the study, they alternated the groups that they supervised ensuring that all groups had time with both physiotherapists. Both groups were also instructed to undertake a further unsupervised exercise session each week. Group A were given instructions on warm-up exercise (appendix 6) and encouraged to walk, participate in a sport such as badminton, or football or to make use of the gymnasium facilities in the physiotherapy departments. The chosen activity was noted on the 7 day recall sheet and monitored by the physiotherapists. Group B were given an exercise sheet with the instructions for the stretching and breathing exercise (appendix 7)

Guidance in completing the 7d physical activity recall form followed by questioning with regards the content of the 7d recall sheets was undertaken at all sites during the three week intervention stage of the study. Subjects completed a sheet for each of the three weeks, this was then discussed with the physiotherapist undertaking the intervention programme.

The twelve week home based exercise programme was a customised booklet containing a structured programme of progressive exercise and weekly targets to

improve levels of physical activity over a 12 week period. This given at the post testing session to subjects in the aerobic and strength exercise group (group A). This was introduced by the researcher along with guidance on usage. The control group (group B) received a booklet with general information on health and fitness supplied .

Two further workshops were held in the fourth and eleventh month of the data gathering stage of the study. Ongoing issues related to the project were discussed. No issues were raised which required the procedures to be changed. The last workshop focused on the research experience for the physiotherapists, implications for their department and future directions, costs and benefits.

### **3.5.7 Procedures for recall and follow-up appointments**

The inclusion of the blood analysis required the researcher to closely collaborate with the consultants at each of the four sites with regard to patient recall appointments. The role of the part-time secretary in arranging and confirming appointments and maintaining constant communication links between the four sites and the research team was crucial to the study.

Subjects were informed of the date of the first follow-up appointment prior to discharge. They were then sent a letter inviting them to attend for the first follow-up appointment confirming the time and date. This was repeated again at five months from date of entry to the programme. The letter was sent out by the secretary two weeks prior to the appointment date. Further letters were sent out at three and four months with a request to complete a physical activity 7 day recall questionnaire for the previous week and to return it to the researcher in the reply paid envelope.

Non attendance at the appointment was followed-up by the researcher. The secretary was informed to send a further appointment for recall and the researcher contacted the key worker appointed to that patient on discharge. The researcher endeavoured to establish from the key worker whether one or more of the following applied: the subject had relapsed to problem drinking; had withdrawn contact from the key worker; was in relapse drinking but still in touch with key worker, had returned to

work; was unwilling to return for follow-up appointment. The most common reason for non return at follow-up was relapsed to problem drinking.

## **CHAPTER 4**

### **RESULTS**

This chapter describes the analysis carried out and reports on the results from the multi-site randomised controlled study.

#### **4.1 ANALYSIS**

All analyses were carried out using the statistical package SPSS (Windows). The distribution of the population scores in many of the variables measured were found to be non-normal and therefore non-parametric methods were used for all analyses. Mann-Whitney two-tailed tests were used for all quantitative measurements to compare change scores from baseline between the two groups. Categorical variables were compared between the two groups using chi-squared and Fisher's exact tests. The power of analyses to detect differences between the groups at five months was low due to the reduced numbers of subjects remaining in the trial. The repeated measures ANOVA originally considered for analyses was not used since this approach is not appropriate when data distribution is non-normal. Analyses were carried out following advice from the Medical Statistics Unit, Edinburgh University. Analyses of the different time points of the study have enabled the hypothesis to be tested and all of the questions set out in the aims of the study can now be answered.

#### **4.2 RESULTS**

The results are reported as follows:

- demographic - age, sex, marital status, smoking status, social class;
- baseline measures - pre test scores for all variables;

- physiological - physical activity, aerobic fitness, strength, flexibility, body weight, resting pulse;
- psychological - anxiety, depression, physical self worth, PSPP sport, PSPP condition, PSPP body, PSPP strength , alcohol SADD;
- blood analysis CDT and self report of drinking behaviour;
- associations between physiological and psychological variables.

A summary of the results highlighting change from baseline at one month, two months and five months is reported in section 4.2.5.

#### **4.2.1 Demographic variables**

Socio-demographic characteristics on age, sex, social class, marital status and clinical site were recorded for each subject at baseline and are summarised in table 9.

<b>Characteristic</b>	<b>Exercise Group A (n=80)</b>	<b>Control Group B (n=78)</b>
<b>Age - means and Standard Deviation</b>	41.26 ( $\pm$ 8.01)	41.70 ( $\pm$ 8.91)
<b>Sex - Male</b>	63	63
<b>Female</b>	20	19
<b>Married</b>	21	23
<b>With partner</b>	17	14
<b>Single</b>	46	44
<b>Smoker</b>	51	57
<b>Social Class I</b>	1	1
<b>II</b>	5	1
<b>III</b>	10	9
<b>IV</b>	21	16
<b>V</b>	47	54

**Table 9** Socio-demographic characteristics at baseline



Both the intervention and control groups included more men than women but gender distribution was similar in the two groups. The 126 males and the 39 women had a mean age of 41 years. The majority of the subjects were in the lower socio-economic groups, (classification of social class by occupation, cited in French, 1992) having previously been employed as either semi-skilled, 22% or unskilled workers, 61%. Only 17% had been employed as professionals, managers, administrators, white collar workers or skilled workers. At the time of treatment only 23% were in employment. More than half of the subjects lived alone being single or divorced, while 27% were married with a further 19% currently living with a partner. A high number of the subjects were also smokers 65%. No difference was found at baseline between groups in any of the socio-demographic characteristics.

#### **4.2.2 Baseline measures - pre-test scores.**

Mann-Whitney U tests were applied to all pre-test scores for all dependent measures: physical activity; aerobic fitness; strength; flexibility; body weight; resting pulse; anxiety; depression; physical self perceptions and alcohol dependence. These are summarised in table 10. No differences were observed between the exercise and control group on baseline measures and group equivalency was assumed.

Variable	BASELINE SCORES ALL VARIABLES		
	Median With 25th and	Values 75th Quartiles	Mann Whitney
	Exercise Group	Control Group	p -value
<b>Physical Activity</b> 10 minute units of time	18 (8.25, 35)	14 (6, 30)	NS
<b>Aerobic Fitness VO<sub>2</sub></b> ML/KG/MIN	26 (22, 30)	26 (22.5, 33.5)	NS
<b>Strength sit-ups</b> Number in one minute	13 (10.75, 16)	13 (10, 17)	NS
<b>Flexibility sit &amp; reach</b> Centimeters	18 (11, 23.75)	18 (13.22)	NS
<b>Body Weight</b> Kilograms	68 (61.25,78)	67 (60,76)	NS
<b>Resting pulse</b> Beats per minute	87.5( 80, 94)	87.5 (83.25, 94)	NS
<b>Anxiety Zung Inventory †</b>	41 (36, 47)	41 (36, 48)	NS
<b>Depression Beck Inventory †</b>	20.5 (13,27)	21 (11.5, 28)	NS
<b>Physical self worth</b> Physical self perception	11 (9, 14)	11 (9, 13)	NS
<b>Sport</b> Physical self perception	12 (8, 14.25)	11 (8, 13)	NS
<b>Condition</b> Physical self perception	11 (8, 14)	11 (9, 13)	NS
<b>Body</b> Physical self perception	11.5 (9.75,13)	11 (9, 13)	NS
<b>Strength</b> Physical self perception	13 (10.75, 16)	13 (10, 17)	NS
<b>Alcohol SADD score †</b>	29 (20, 34)	27 (21, 32.5)	NS

**Table 10** Median Scores at Baseline for all Variables

Normative data suggest the following categories of severity. BDI depression: normal 0-9; mild 10-15; mild to moderate 16-19; moderate to severe 20-29; severe >29. SADD dependence levels: low 1-9; medium 10- 19; high >20. Zung anxiety raw scores: normal 21-31; anxiety disorder 36-56.

### **Post-Test Scores**

Mann-Whitney U tests were applied to all post-test scores at one month, two months, and five months from baseline, for all dependent physiological measures: physical activity; aerobic fitness; strength; flexibility; body weight; resting pulse; summarised in table 11 and all dependent psychological measures: anxiety; depression; physical self perceptions and alcohol dependence summarised in table 12. The results have been grouped together under physiological and psychological measures and will be reported in turn.

Variable	1 Month				2 Month				5 Month			
	Median With 25% and 75% Quartiles	Exercise Group	Control Group	Mann Whitney p-value	Median With 25% and 75% Quartiles	Exercise Group	Control Group	Mann Whitney p-value	Median With 25% and 75% Quartiles	Exercise Group	Control Group	Mann Whitney p-value
Physical Activity	13 (23.2)	6 (14.2)	NS (.08)	20 (40.7)	8.5 (18, 1.5)	<.02	13 (-1, 27)	9 (0, -18)	NS			
Acrobic Fitness VO <sub>2</sub>	5 (7.1.5)	0 (2, -1.8)	<.0001	5 (8.2.5)	0 (2.75, -2)	<.0001	5 (8.2)	1 (3.2, -1.5)	<.003			
Strength sit-ups	4 (6.2)	2.5 (4.1)	<.008	5 (6.3)	2 (5, 0)	<.0005	5 (7.2)	2.5 (6, 1)	NS			
Flexibility sit & reach	2 (4.1)	1.5 (4.0)	NS	3 (4.5, 1)	1.5 (4.0)	NS	2 (4.5, -1)	1.5 (4.5, 0)	NS			
Body Weight	1 (2.0)	1 (2.0)	NS	0 (2, -1)	1 (1, -2)	<.04	5 (3, -3)	0 (1, -2)	NS			
Resting Pulse	-2 (1, -6)	1 (1, -3.8)	NS	-2 (3, -9.5)	1 (3.5, -6)	NS	-3.5 (8, -13)	1 (2, -4)	NS			

**Table 11** Medians and Quartiles for the Changes from Baseline for all Physical Measures

### **4.2.3 Post-Test Scores all Physiological Variables**

#### **4.2.3.1 Physical Activity - 7 day recall diary**

Mann-Whitney U tests were applied to compare change scores in physical activity from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 3. In addition postal returns of this measure of activity were gathered at three and four months.

##### **One Month from Baseline**

Mann-Whitney U

At one month from baseline the exercise group were participating in more physical activity than the control group but the difference was not significant ( $p < 0.08$ ) (see table 11 and figure 3). The mean rank for the exercise group was 63.61 ( $n = 61$ ) and for the control group 52.84 ( $n = 56$ ). The results were found to be just outside the significant level,  $U = 1366.0$ ,  $p = .0848$ .

##### **Two Months from Baseline**

Mann-Whitney U

At two months from baseline the exercise group were more physically active than the control group ( $p < 0.02$ ) (see table 11 and figure 3). The mean rank for the exercise group was 40.26 ( $n = 37$ ) and for the control group 28.92 ( $n = 33$ ). The results were found to be significant at  $p < 0.02$ ,  $U = 397.5$ ,  $p = .0192$ . This means that the exercise group and the control group differ significantly in their levels of physical activity, with the exercise group at this time point undertaking more physical activity.

##### **Three Months from Baseline**

Mann-Whitney U

At three months from baseline the exercise group were still more physically active than the control group in levels of activity ( $p < 0.04$ ). The mean rank for the exercise group was 35.17 ( $n = 30$ ) and for the control group 25.83 ( $n = 30$ ). The results were found to be significant at  $p < 0.04$ ,  $U = 310$ ,  $p = .0384$ .

**Four Months from Baseline**

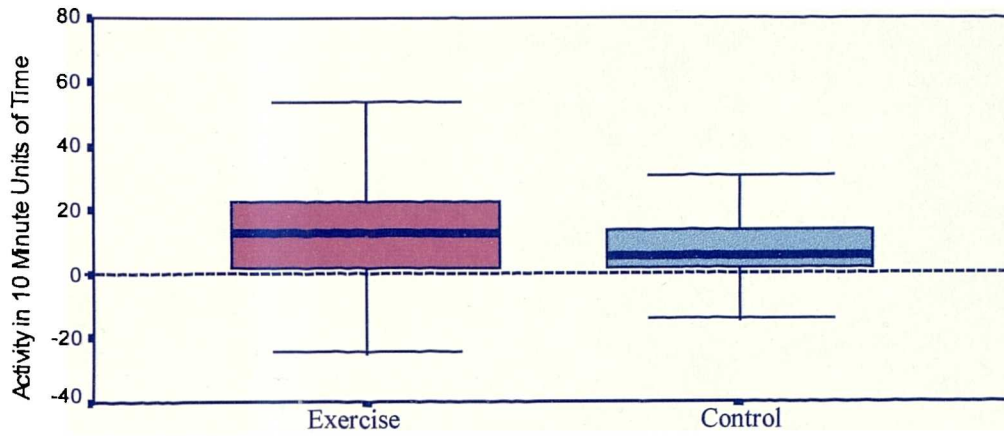
## Mann-Whitney U

There was no longer a significant difference between the two groups in levels of physical activity. The mean rank for the exercise group was 23.61 ( $n = 23$ ) and for the control group 22.36 ( $n = 22$ ). The results were found not to be significant  $U = 239$ ,  $p = .7505$ .

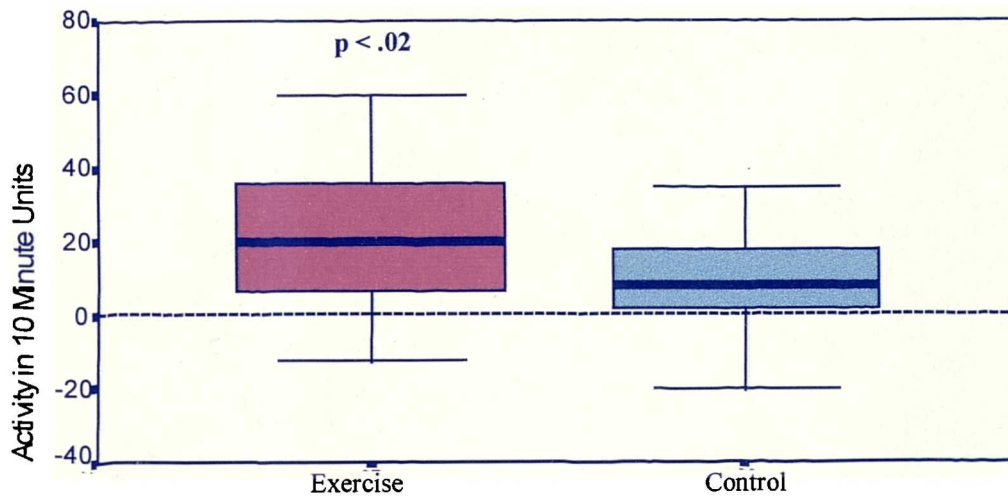
**Five months from baseline**

## Mann-Whitney U

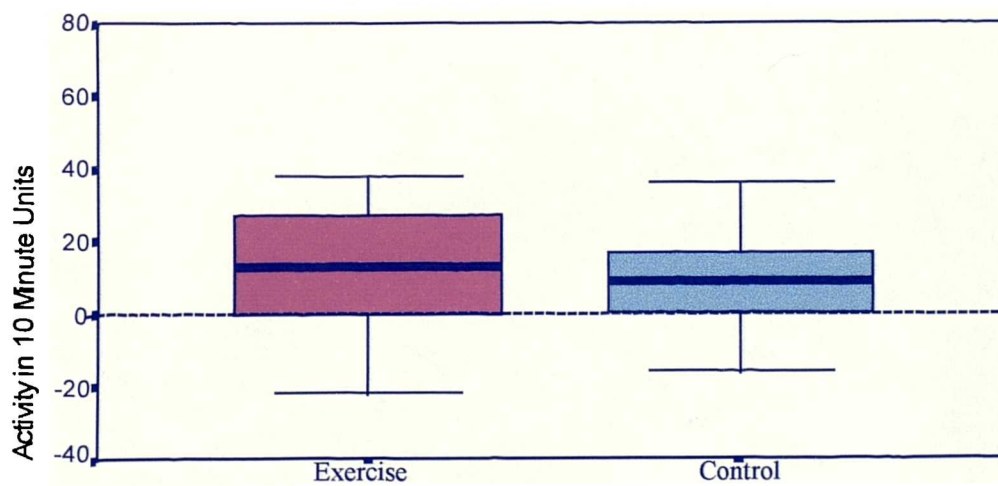
At five months from baseline the exercise group were no longer significantly more physically active than the control group although they were still maintaining increased levels of physical activity (see table 11 and figure 3). The mean rank for the exercise group was 23.07 ( $n = 22$ ) and for the control group 22.08 ( $n = 21$ ). The results were found not to be significant  $U = 207.5$ ,  $p = .5675$ .



**1 Month**



**2 Month**



**5 Month**

**Figure 3** Median Changes, Quartiles, and Ranges in Time in Activity over 7 days

#### **4.2.3.2 Aerobic Fitness - estimated max. VO<sub>2</sub>.**

Mann-Whitney U tests were applied to compare change scores in aerobic fitness from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 4.

##### **One month from Baseline**

###### **Mann-Whitney U**

At one month from baseline the exercise group had improved in the physiological parameters of estimated max. VO<sub>2</sub> ( $p < 0.0001$ ) (see table 11 and figure 4).

The mean rank for the exercise group was 75.36 ( $n = 61$ ) and for the control group 41.28 ( $n = 56$ ). The results were found to be significant,  $U = 710$ ,  $p = .0001$ . This means that the exercise group and the control group differ significantly in their levels of aerobic fitness, with the exercise group at this time point being aerobically fitter.

##### **Two months from baseline**

###### **Mann-Whitney U**

At two months from baseline the exercise group maintained improvement in the physiological parameters of estimated max. VO<sub>2</sub> ( $p < 0.0001$ ) (see table 11 and figure 4). The mean rank for the exercise group was 44.62 ( $n = 37$ ) and for the control group 23.88 ( $n = 33$ ). The results were found to be significant at  $p < 0.0001$ ,  $U = 236$ ,  $p = .0001$ . This means that the exercise group and the control group continue to differ significantly in their levels of aerobic fitness, with the exercise group at this time point being aerobically fitter.

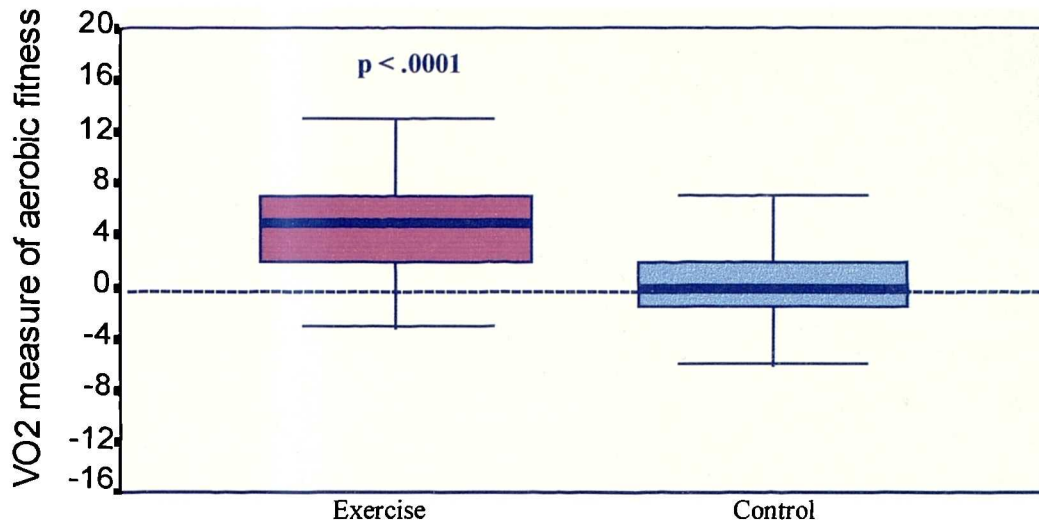
##### **Five months from baseline**

###### **Mann-Whitney U**

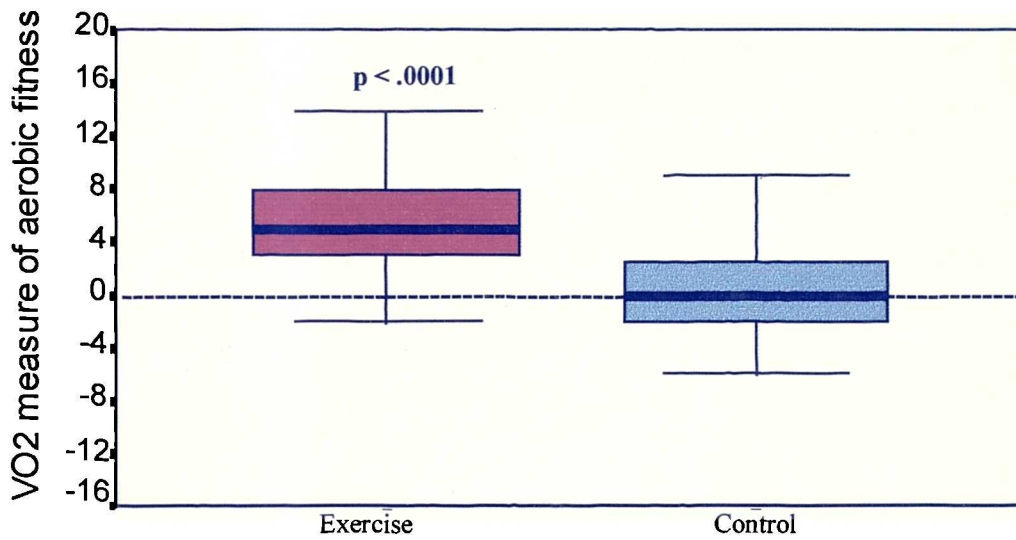
At five months from baseline the exercise group maintained improvement in the physiological parameters of estimated max. VO<sub>2</sub> ( $p < 0.003$ ) (see table 11 and figure 4). The mean rank for the exercise group was 28.27 ( $n = 22$ ) and for the control group 16.73 ( $n = 21$ ). The results were found to be significant at  $p < 0.003$ ,



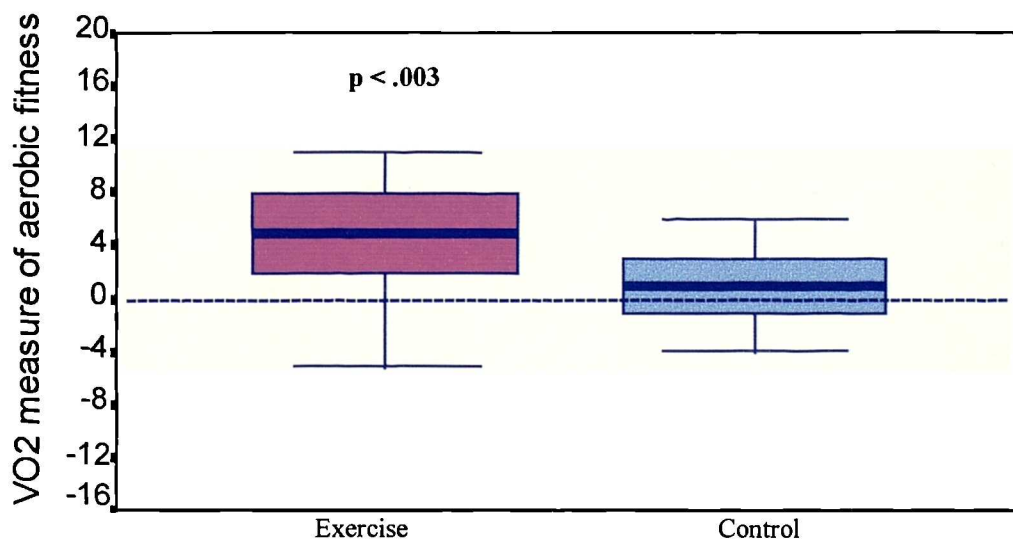
$U = 115$ ,  $p = .0028$ . This means that the exercise group and the control group continue to differ significantly in their levels of aerobic fitness, with the exercise group at this time point being aerobically fitter.



1 Month



2 Month



5 Month

Figure 4 Median Changes, Quartiles and Ranges in Vo2 A Measure of Aerobic Fitness

### 4.2.3.3 Strength - Abdominal Muscle Endurance

Mann-Whitney U tests were applied to compare change scores in abdominal muscle strength from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 5.

#### One month from baseline

##### Mann-Whitney U

At one month from baseline the exercise group improved in the physical measure of abdominal muscle strength ( $p < 0.008$ ) (see table 11 and figure 5).

The mean rank for the exercise group was 66.91 ( $n = 61$ ) and for the control group 50.38 ( $n = 56$ ). The results were found to be significant at  $p < 0.008$ ,  $U = 1225.5$ ,  $p = .0082$ . This means that the exercise group and the control group differ significantly in their levels of strength, with the exercise group at this time point having greater abdominal muscle strength.

#### Two months from baseline

##### Mann-Whitney U

The exercise group continued to improve in the physical measure of abdominal muscle strength at two months  $p < 0.0005$  (see table 11 and figure 5).

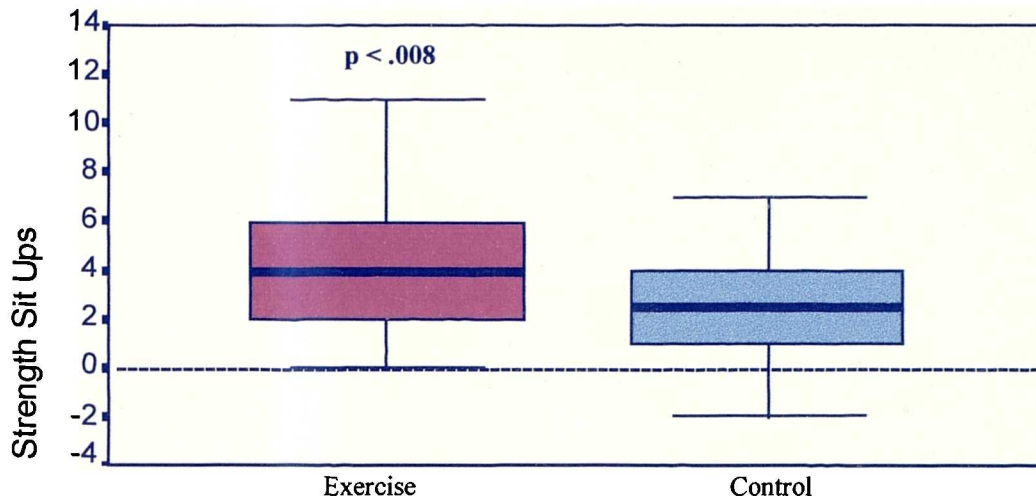
The mean rank for the exercise group was 42.78 ( $n = 37$ ) and for the control group 26.00 ( $n = 33$ ). The results were found to be significant at  $p < 0.0005$ ,  $U = 304$ ,  $p = .0005$ . This means that the exercise group and the control group differ significantly in their levels of strength, with the exercise group at this time point having greater abdominal muscle strength.

#### Five Months from Baseline

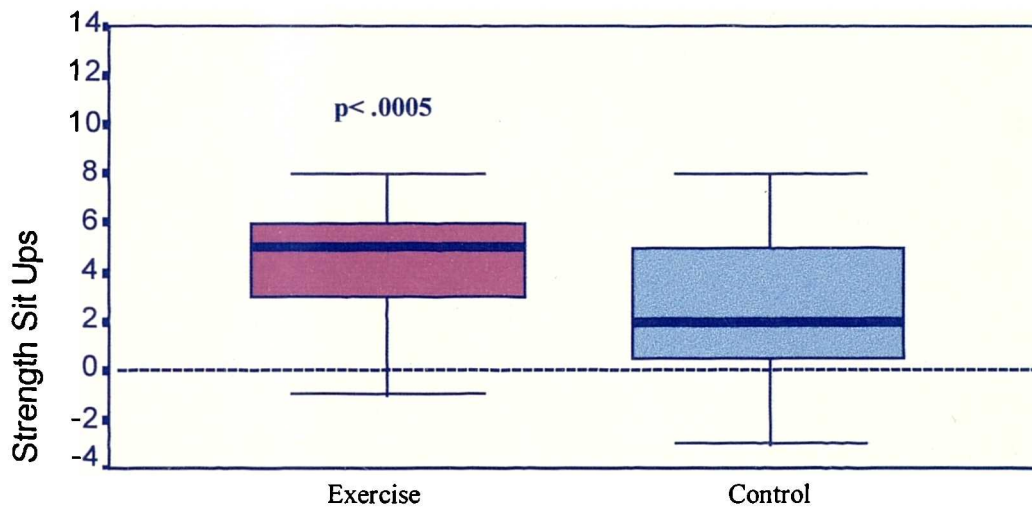
##### Mann-Whitney U

The exercise group did not maintain improvement in the physical measure of abdominal muscle strength at five months (see table 11 and figure 5).

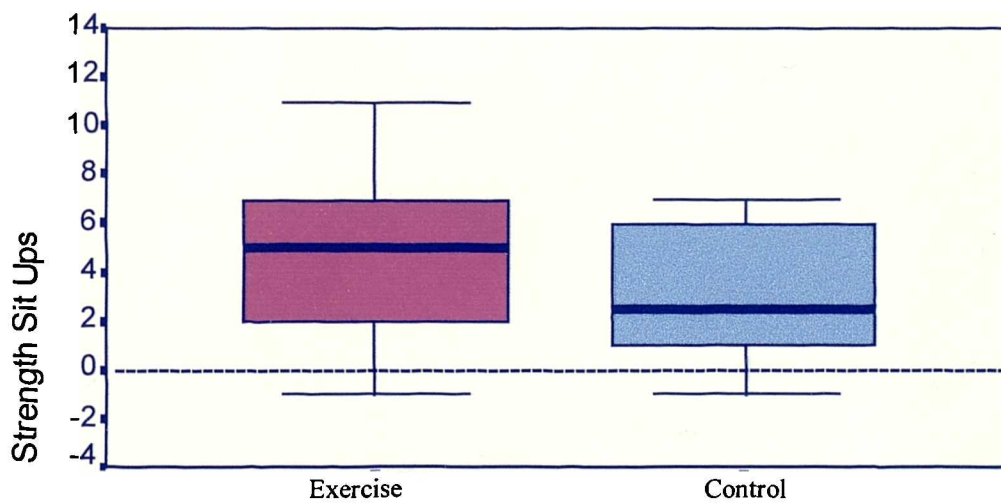
The mean rank for the exercise group was 25.57 ( $n = 22$ ) and for the control group 19.43 ( $n = 21$ ). The results were found to be not significant,  $U = 174$ ,  $p = .1107$ .



**1 Month**



**2 Month**



**5 Month**

**Figure 5** Median Changes, Quartiles and Ranges in Strength

#### 4.2.3.4 Flexibility - Sit and Reach

Mann-Whitney U tests were applied to compare change scores in flexibility from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 6.

##### **One month from baseline**

Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the physical measure of flexibility (see table 11 and figure 6). The mean rank for the exercise group was 62.96 ( $n = 61$ ) and for the control group 54.69 ( $n = 56$ ). The results were found not to be significant,  $U = 1466.5$ ,  $p = .1842$ .

##### **Two months from baseline**

Mann-Whitney U

At two months from baseline there was still no significant difference between the groups in the physical measure of flexibility (see table 11 and figure 6).

The mean rank for the exercise group was 38.46 ( $n = 37$ ) and for the control group 31.00 ( $n = 33$ ). The results were found not to be significant,  $U = 464$ ,  $p = .1212$ .

##### **Five months from baseline**

Mann-Whitney U

At five months from baseline there was still no significant difference between the groups in the physical measure of flexibility (see table 11 and figure 6).

The mean rank for the exercise group was 22.55 ( $n = 22$ ) and for the control group 21.48 ( $n = 21$ ). The results were found not to be significant,  $U = 219.5$ ,  $p = .7791$ .

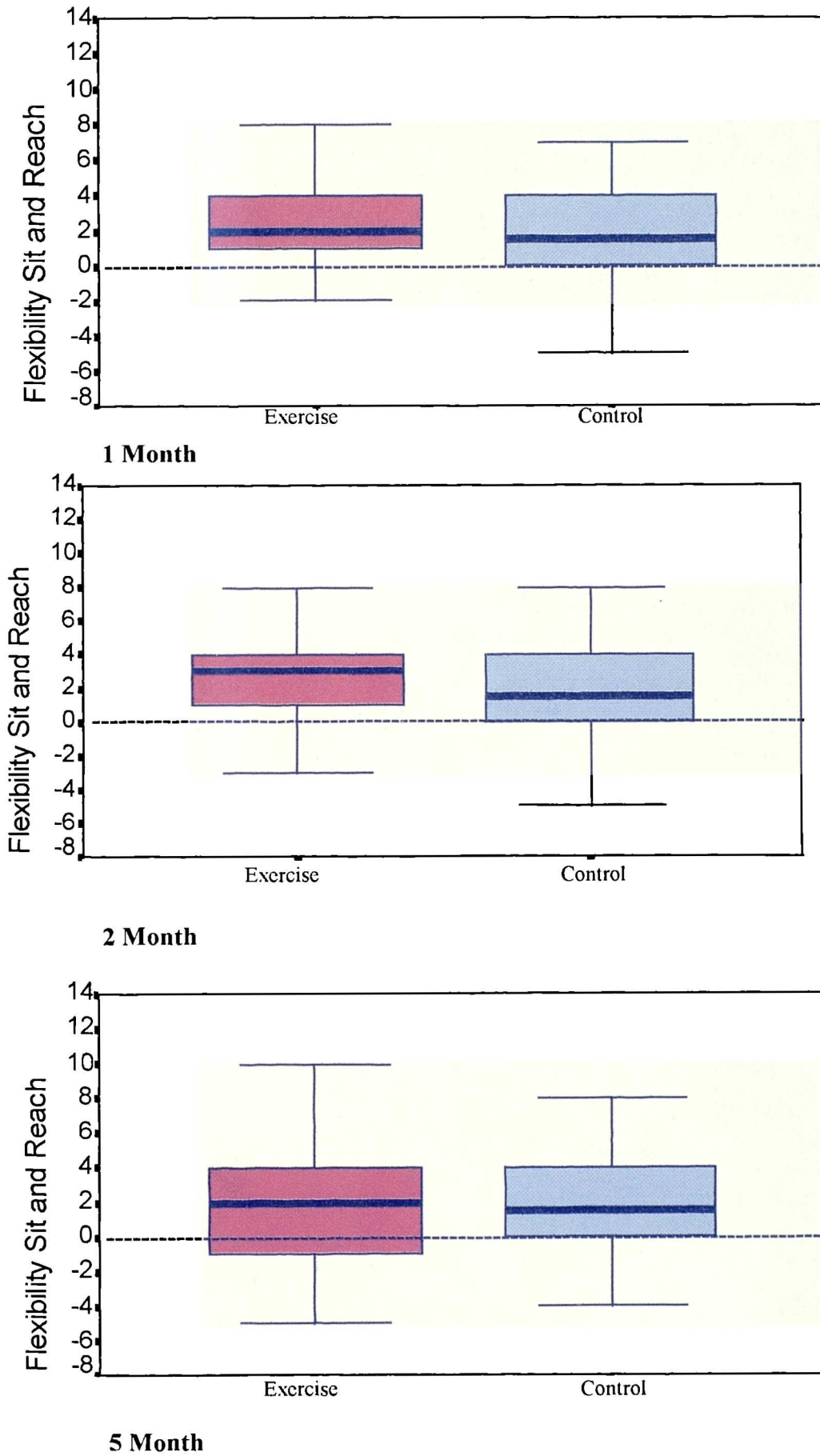


Figure 6 Median Changes, Quartiles, and Ranges in Flexibility

#### 4.2.3.5 Body Weight Kilograms

Mann-Whitney U tests were applied to compare change scores in body weight from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 7.

##### **One month from baseline**

Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the physical measure of body weight (see table 11 and figure 7). The mean rank for the exercise group was 58.11 ( $n = 61$ ) and for the control group 59.96 ( $n = 56$ ). The results were found not to be significant,  $U = 1654$ ,  $p = .7639$ .

##### **Two months from baseline**

Mann-Whitney U

At two months from baseline there was a difference between the groups in the physical measure of body weight with the control group having a reduction in weight from baseline measures  $p < 0.04$  (see table 11 and figure 7). The mean rank for the exercise group was 40.05 ( $n = 37$ ) and for the control group 30.39 ( $n = 33$ ). The results were found to be significant at  $p < 0.04$ ,  $U = 442.0$ ,  $p = .0447$ . This means that the exercise group and the control group differ significantly in their body weight, with the exercise group at this time point having maintained their body weight while the control group have lost weight.

##### **Five months from baseline**

Mann-Whitney U

At five months from baseline there was no longer any difference between the groups in the physical measure of body weight (see table 11 and figure 7).

The mean rank for the exercise group was 22.73 ( $n = 22$ ) and for the control group 21.24 ( $n = 21$ ). The results were found not to be significant,  $U = 215.0$ ,  $p = .6960$ .

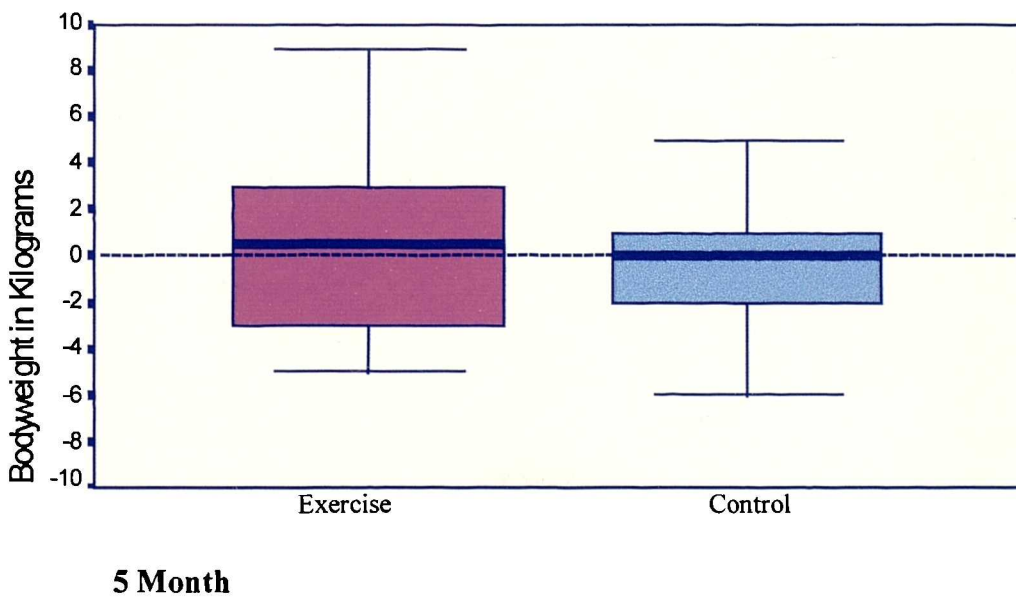
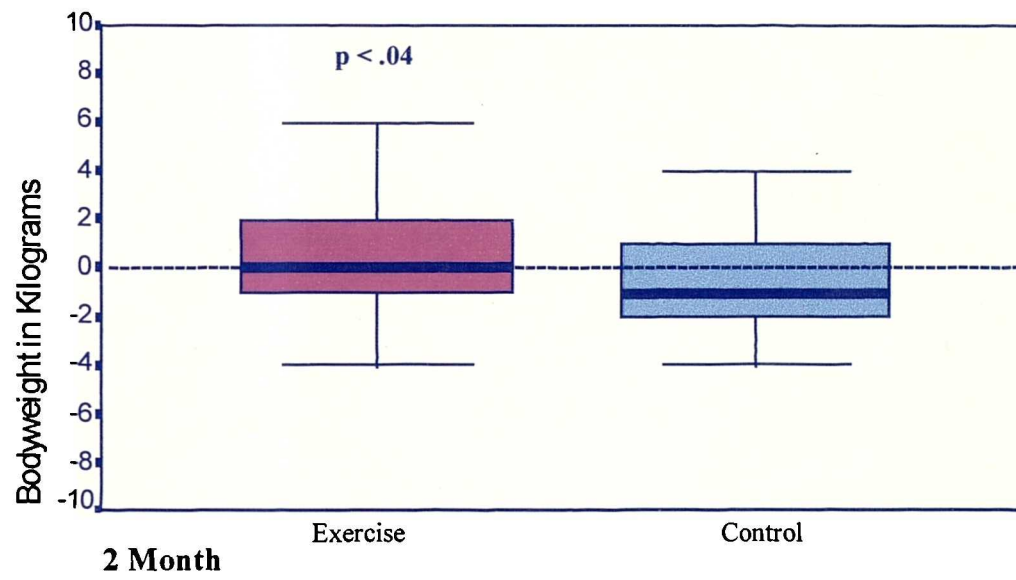
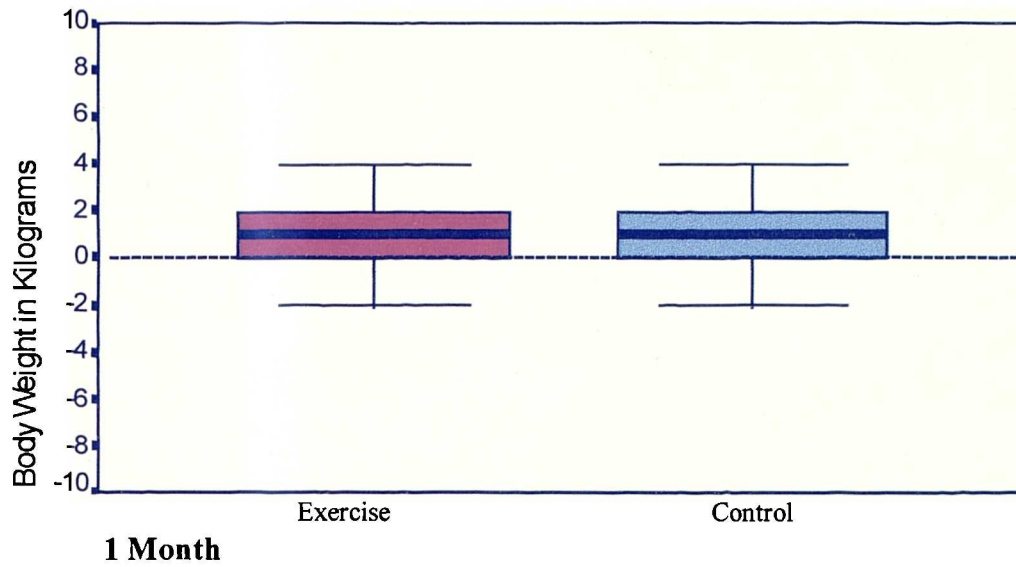


Figure 7 Median Changes, Quartiles and Ranges in Body Weight



#### 4.2.3.6 Resting Pulse

Mann-Whitney U tests were applied to compare change scores in resting pulse from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 11 and in figure 8.

##### **One month from baseline**

Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the physical measure of resting pulse (see table 11 and figure 8). The mean rank for the exercise group was 54.75 ( $n = 61$ ) and for the control group 63.63 ( $n = 56$ ). The results were found not to be significant,  $U = 1448.5$ ,  $p = .1554$ .

##### **Two month from baseline**

Mann-Whitney U

At two months from baseline there was still no significant difference between the groups in the physical measure of resting pulse (see table 11 and figure 8).

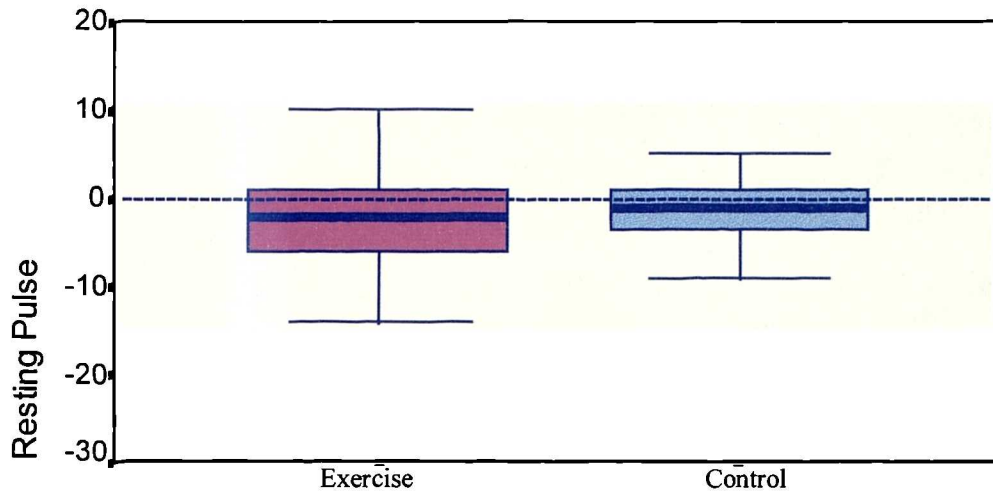
The mean rank for the exercise group was 34.19 ( $n = 37$ ) and for the control group 36.97 ( $n = 33$ ). The results were found not to be significant,  $U = 562$ ,  $p = .5677$ .

##### **Five month from baseline**

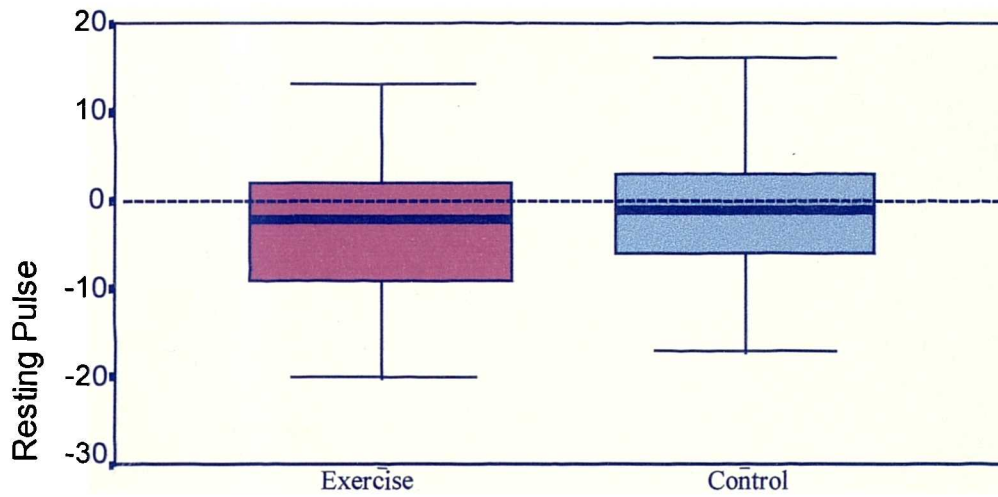
Mann-Whitney U

At five months from baseline there was still no significant difference between the groups in the physical measure of resting pulse (see table 11 and figure 8).

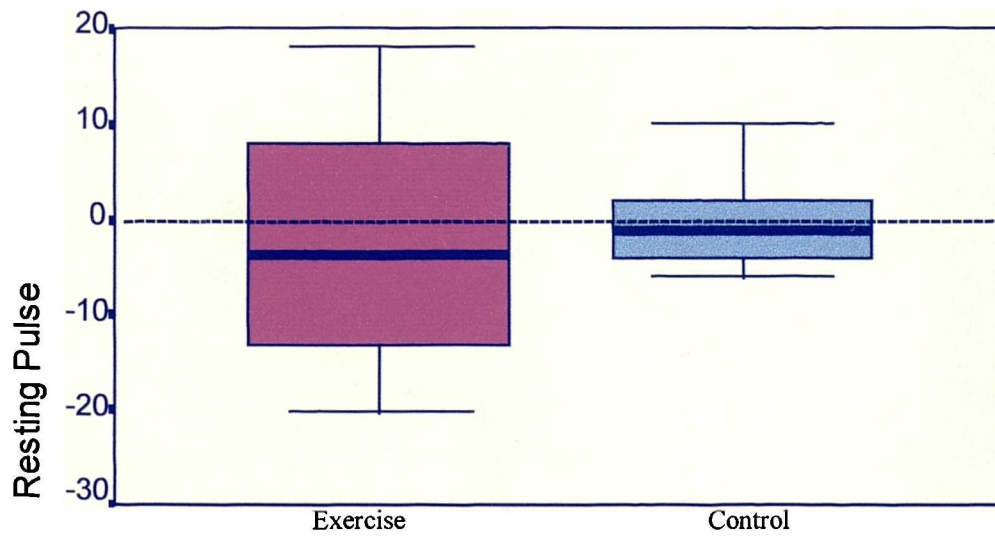
The mean rank for the exercise group was 23.16 ( $n = 22$ ) and for the control group 20.79 ( $n = 21$ ). The results were not found to be significant,  $U = 115$ ,  $p = .5348$ .



**1 Month**



**2 Month**



**5 Month**

**Figure 8** Median Changes, Quartiles and Ranges in Resting Pulse

#### **4.2.4 Post-Test scores for all Psychological variables**

##### **4.2.4.1 Anxiety**

Mann-Whitney U tests were applied to compare change scores in anxiety from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 9.

No difference was found between groups although it was observed that anxiety scores were lower in both groups. Within group differences were explored using Wilcoxon signed-ranks test, these results are reported for all time points.

##### **One month from baseline**

Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the psychological measure of anxiety (see table 12 and figure 9).

The mean rank for the exercise group was 56.78 ( $n = 61$ ) and for the control group 61.42 ( $n = 56$ ). The results were not found to be significant,  $U = 1572.5$ ,  $p = .4591$ .

Wilcoxon signed-ranks test

At one month there was a significant reduction in anxiety for both the exercise group and the control group ( $p < 0.0001$ ). Exercise group  $T = 5.9776$ ,  $N = 61$ ,  $p = 0.0001$ , control group  $T = 4.9930$ ,  $N = 56$ ,  $p = 0.0001$ , these results suggest that subjects in both the exercise and control group were less anxious at one month.

Variable	1 Month			2 Month			5 Month		
	Median With 25% and 75% Quartiles	Values 75% Quartiles	Mann Whitney p-value	Median With 25% and 75% Quartiles	Values 75% Quartiles	Mann Whitney p-value	Median With 25% and 75% Quartiles	Values 75% Quartiles	Mann Whitney p-value
Anxiety	Exercise Group	Control Group	NS	Exercise Group	Control Group	NS	Exercise Group	Control Group	NS
Zung	-6 (-2.5, -11)	-6 (-1.2, -10.7)	NS	-8 (-2.5, -12)	-7 (-2.5, -10)	NS	-4 (1.2, -11)	-5 (-1, -13)	NS
Depression	Exercise Group	Control Group	NS	Exercise Group	Control Group	NS	Exercise Group	Control Group	NS
BDI	-11 (-5, -15)	-12 (-5, -17)	NS	-8 (-3.5, -14.5)	-10.5 (-4, -15.7)	NS	-6 (-0.5, -12)	-9.5 (-4.5, -18)	NS
Physical Self Worth PSPP	2 (3, 1)	1 (2, 0)	<.02	2 (3, -1)	0 (1.7, -0.7)	NS (.09)	1 (4, -0.2)	0 (1, -1)	NS
Sport PSPP	1 (2.5, -1)	0 (1, -1)	NS	1 (3, -1)	0 (2, -1)	NS	0 (2.2, -1)	0.5 (3, -1)	NS
Condition PSPP	1 (3, 0)	0 (2, -1)	<.007	3 (4, 1)	0 (2, -1)	<.001	1 (4.2, -1)	0 (2.2, -1)	NS
Body PSPP	1 (2, 0)	0 (2, -1)	NS (.09)	1 (3, 0)	1 (2, -1)	NS (.07)	1 (3.2, -1)	0 (1.2, -1)	NS
Strength PSPP	1 (3, 0)	0 (1, -1)	<.003	2 (4, 0)	-1 (1, -3.7)	<.002	1 (3, -2)	-1 (1, -3)	NS (.09)
Alcohol SADD	-4 (1, -8)	-1 (1.7, -4.7)	NS (.07)	-5 (-0.5, -12)	-2.5 (1, -10.5)	NS	-5.5 (1.2, -10.5)	-4.5 (0.2, -11)	NS

Table 12

Medians and Quartiles for the Changes from Baseline for all Psychological Measures

**Two months from baseline**

## Mann-Whitney U

At two months from baseline there was still no significant difference between the groups in the psychological measure of anxiety (see table 12 and figure 9).

The mean rank for the exercise group was 33.80 ( $n = 37$ ) and for the control group 36.39 ( $n = 33$ ). The results were found not to be significant,  $U = 547.5$ ,  $p = .5917$ .

## Wilcoxon signed-ranks test

At two months there was a significant within group reduction in anxiety for both the exercise group and the control group ( $p < 0.0001$ ).

Exercise group  $T = 4.3204$ ,  $N = 37$ ,  $p = 0.0001$ , control group  $T = 3.3624$ ,  $N = 33$ ,  $p = 0.0001$ , these results suggest that subjects in both the exercise and control group continued to be less anxious at two months.

**Five months from baseline**

## Mann-Whitney U

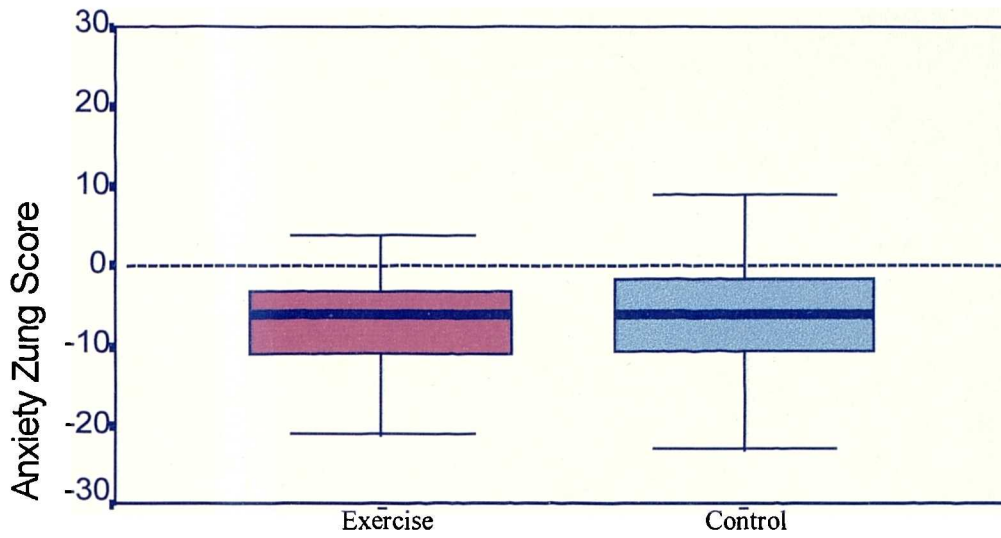
At five months from baseline there was still no significant difference between the groups in the psychological measure of anxiety (see table 12 and figure 9).

The mean rank for the exercise group was 23.59 ( $n = 22$ ) and for the control group 21.41 ( $n = 21$ ). The results were not found to be significant,  $U = 218.0$ ,  $p = .5724$ .

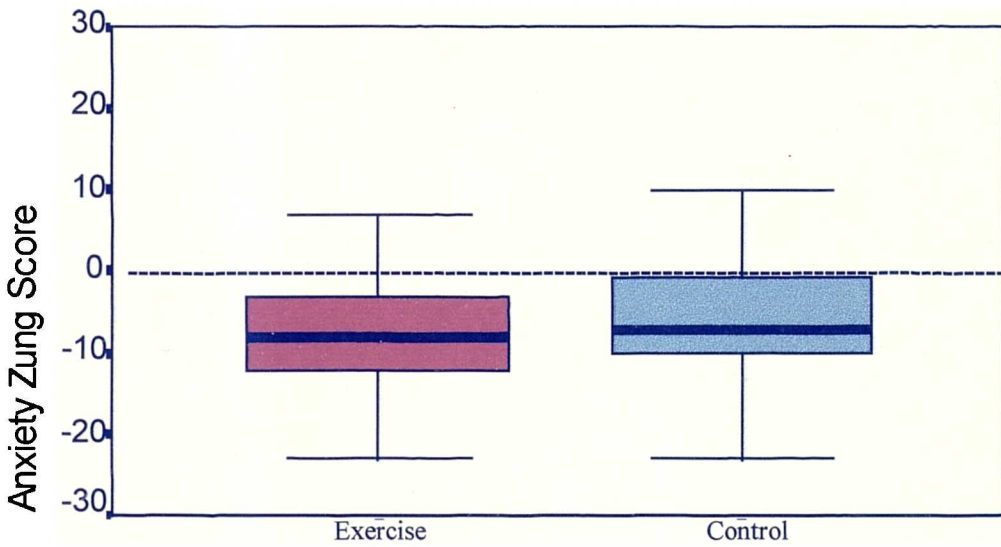
## Wilcoxon signed-ranks test

At five months there was a significant within group reduction in anxiety for both the exercise group ( $p < 0.05$ ) and the control group ( $p < 0.002$ ).

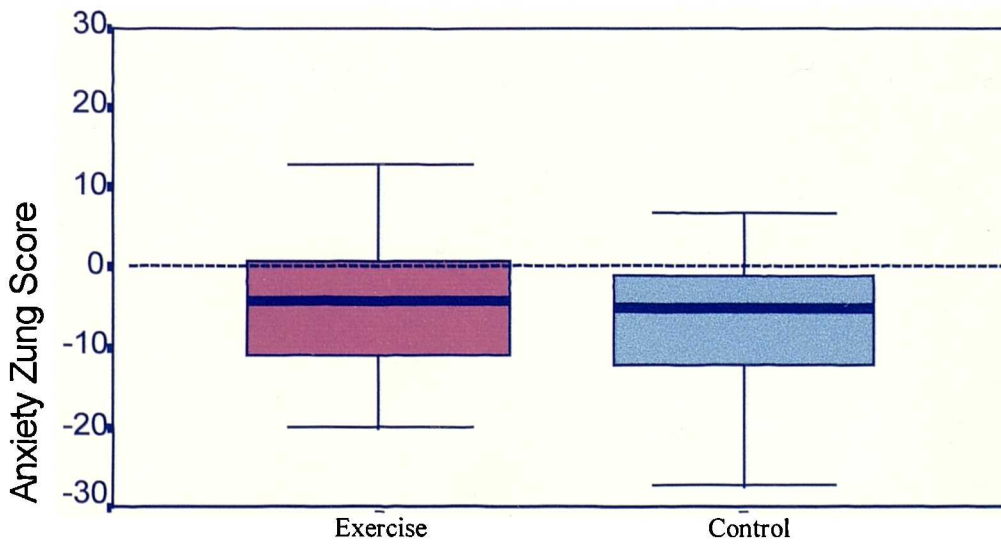
Exercise group  $T = 1.8992$ ,  $N = 22$ ,  $p = 0.05$ , control group  $T = 2.9868$ ,  $N = 21$ ,  $p = 0.002$ , these results suggest that subjects in both the exercise and control group still remain less anxious at five months than at intake to the programme.



**1 Month**



**2 Month**



**5 Month**

**Figure 9** Median Changes, Quartiles, and Ranges in Anxiety Scores

#### 4.2.4.2 Depression

Mann-Whitney U tests were applied to compare change scores in depression from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 10. No difference was found between groups although it was observed that there had been a lowering of depression scores in both groups. Within group differences were explored using Wilcoxon signed-ranks test, these results are reported for all time points.

##### One month from baseline

###### Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the psychological measure of depression (see table 12 and figure 10).

The mean rank for the exercise group was 58.21 ( $n = 61$ ) and for the control group 59.72 ( $n = 56$ ). The results were not found to be significant,  $U = 1664.0$ ,  $p = .8100$ .

###### Wilcoxon signed-ranks test

At one month there was a significant reduction in depression for both the exercise group and the control group ( $p < 0.0001$ ). Exercise group  $T = 6.4384$ ,  $N = 61$ ,  $p = 0.0001$ , control group  $T = 5.9066$ ,  $N = 56$ ,  $p = 0.0001$ , these results suggest that subjects in both the exercise and control group had less symptoms of depression at one month than when they entered the programme.

##### Two month from baseline

###### Mann-Whitney U

At two months from baseline there was still no significant difference between the groups in the psychological measure of depression (see table 12 and figure 10).

The mean rank for the exercise group was 36.37 ( $n = 37$ ) and for the control group 33.53 ( $n = 33$ ). The results were not found to be significant,  $U = 544.0$ ,  $p = .5631$ .

#### Wilcoxon signed-ranks test

At two months there was a significant reduction in depression for both the exercise group and the control group ( $p < 0.0001$ ).

Exercise group  $T = 5.9776$ ,  $N = 37$ ,  $p = 0.0001$ , control group  $T = 4.6089$ ,  $N = 33$ ,  $p = 0.0001$ , these results suggest that subjects in both the exercise and control group continue to have reduced symptoms of depression at two months.

#### Five month from baseline

##### Mann-Whitney U

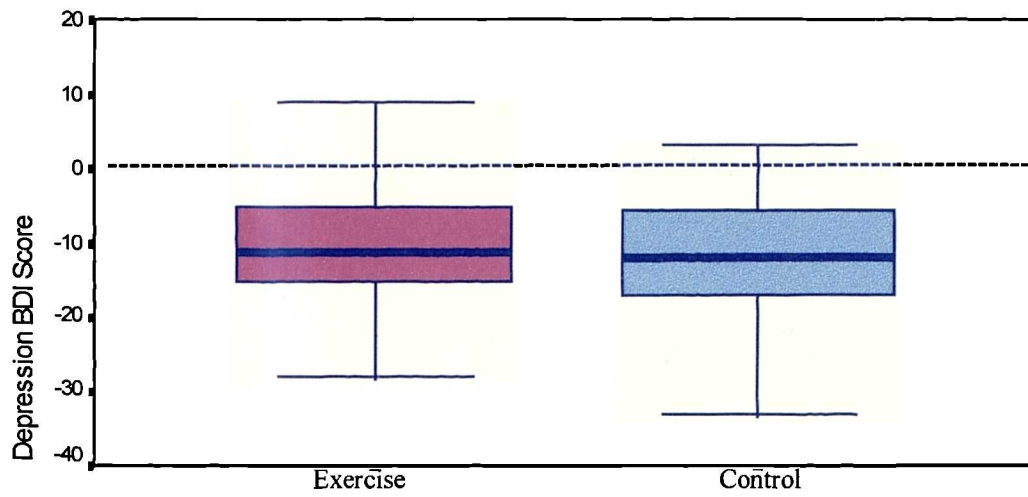
At five months from baseline there was still no significant difference between the groups in the psychological measure of depression (see table 12 and figure 10).

The mean rank for the exercise group was 20.18 ( $n = 22$ ) and for the control group 24.82 ( $n = 21$ ). The results were found not to be significant  $U = 191.0$ ,  $p = .2308$ .

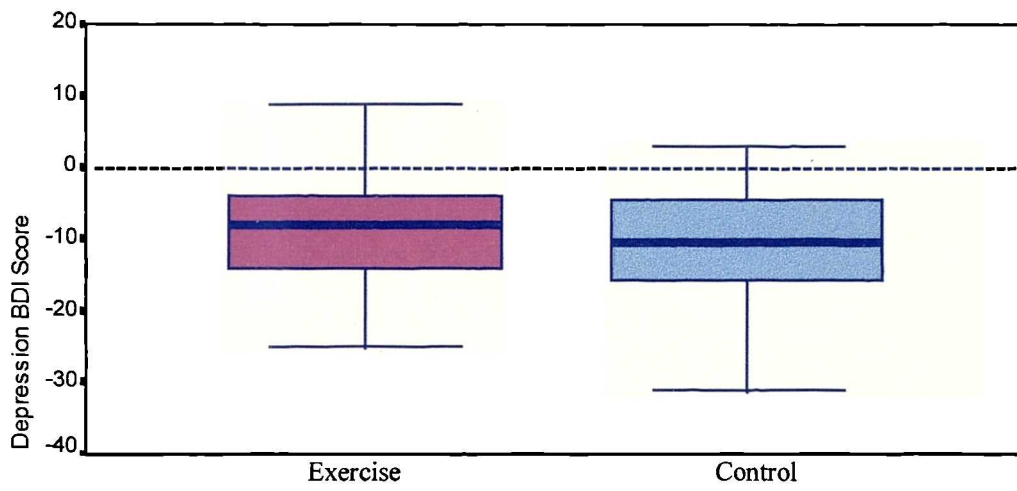
#### Wilcoxon signed-ranks test

At five months there was a significant reduction in depression for both the exercise group ( $p < 0.002$ ) and the control group ( $p < 0.001$ ). Exercise group  $T = 3.0842$ ,  $N = 22$ ,  $p = 0.002$ , control group  $T = 3.2628$ ,  $N = 21$ ,  $p = 0.001$ , these results suggest that subjects in both the exercise and control group continue to have reduced symptoms of depression at five months.

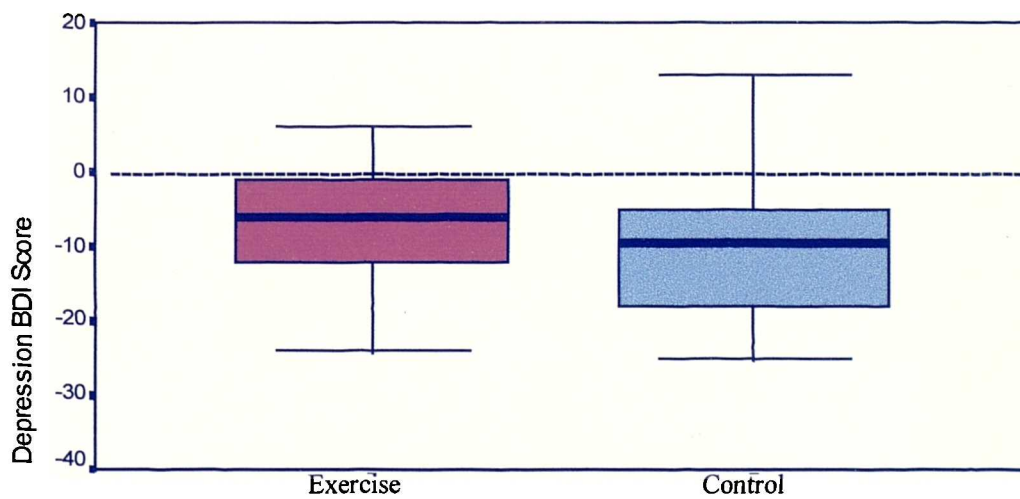




**1 Month**



**2 Month**



**5 Month**

**Figure 10** Median Changes, Quartiles, and Ranges in Depression Scores

#### 4.2.4.3 Physical Self-Perception Profile - Self-Worth

Mann-Whitney U tests were applied to compare change scores in physical self-worth from baseline to one month, between the exercise group and the control group. This was repeated at two months and five months. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 11.

##### **One month from baseline**

###### Mann-Whitney U

At one month from baseline the exercise group improved significantly in the psychological measure of physical self-worth ( $p < 0.02$ ) (see table 12 and figure 11). The mean rank for the exercise group was 69.54 ( $n = 61$ ) and for the control group 51.44 ( $n = 56$ ). The results were found to be significant at  $p < 0.02$ ,  $U = 1284.5$ ,  $p = .0189$ . This means that the exercise group and the control group differ significantly in physical self-worth with the exercise group at this time point having greater physical self-worth than the control group.

##### **Two months from baseline**

###### Mann-Whitney U

At two months from baseline the exercise group did not maintain a significant level of improvement in the psychological measure of physical self-worth (see table 12 and figure 11). The mean rank for the exercise group was 38.78 ( $n = 37$ ) and for the control group 30.63 ( $n = 32$ ). The results were found not to be significant,  $U = 452.0$ ,  $p = .0891$ .

##### **Five months from baseline**

###### Mann-Whitney U

At five months from baseline there was no difference between groups on the psychological measure of physical self-worth (see table 12 and figure 11).

The mean rank for the exercise group was 25.36 ( $n = 22$ ) and for the control group 19.94 ( $n = 21$ ). The results were found not to be significant,  $U = 179.0$ ,  $p = .1347$ .

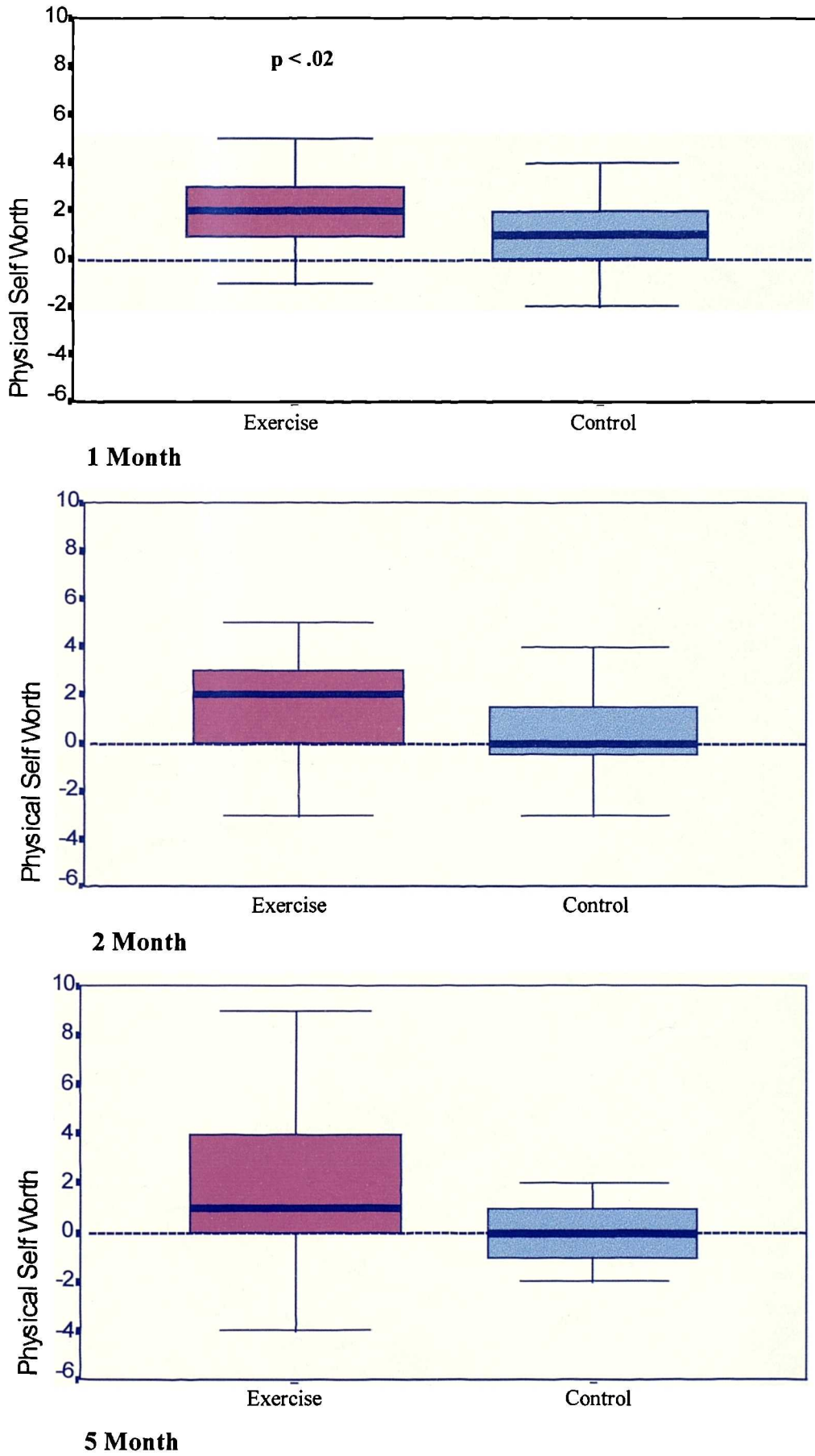


Figure 11 Median Changes, Quartiles, and Ranges in Physical Self Worth

#### 4.2.4.4 Physical Self-Perception Profile - Sport

Mann-Whitney U tests were applied to compare change scores in physical self-perception in relation to sport competence. Scores from baseline to one month, two month and five month between the exercise group and the control group are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and figure 12.

##### **One month from baseline**

Mann-Whitney U

At one month from baseline there was no difference between the groups in psychological measure of self-perception of sport competence (see table 12 and figure 12). The mean rank for the exercise group was 63.05 ( $n = 61$ ) and for the control group 54.09 ( $n = 56$ ). The results were found not to be significant,  $U = 146.0$ ,  $p = .1728$ .

##### **Two months from baseline**

Mann-Whitney U

At two months from baseline there was no difference between the groups in psychological measure of self-perception of sport competence (see table 12 and figure 12). The mean rank for the exercise group was 37.43 ( $n = 37$ ) and for the control group 32.19 ( $n = 32$ ). The results were found not to be significant,  $U = 502.0$ ,  $p = .2745$ .

##### **Five months from baseline**

Mann-Whitney U

At five months from baseline there was no difference between the groups in psychological measure of self-perception of sport competence (see table 12 and figure 12). The mean rank for the exercise group was 21.61 ( $n = 22$ ) and for the control group 23.39 ( $n = 21$ ). The results were found not to be significant,  $U = 222.5$ ,  $p = .6431$ .

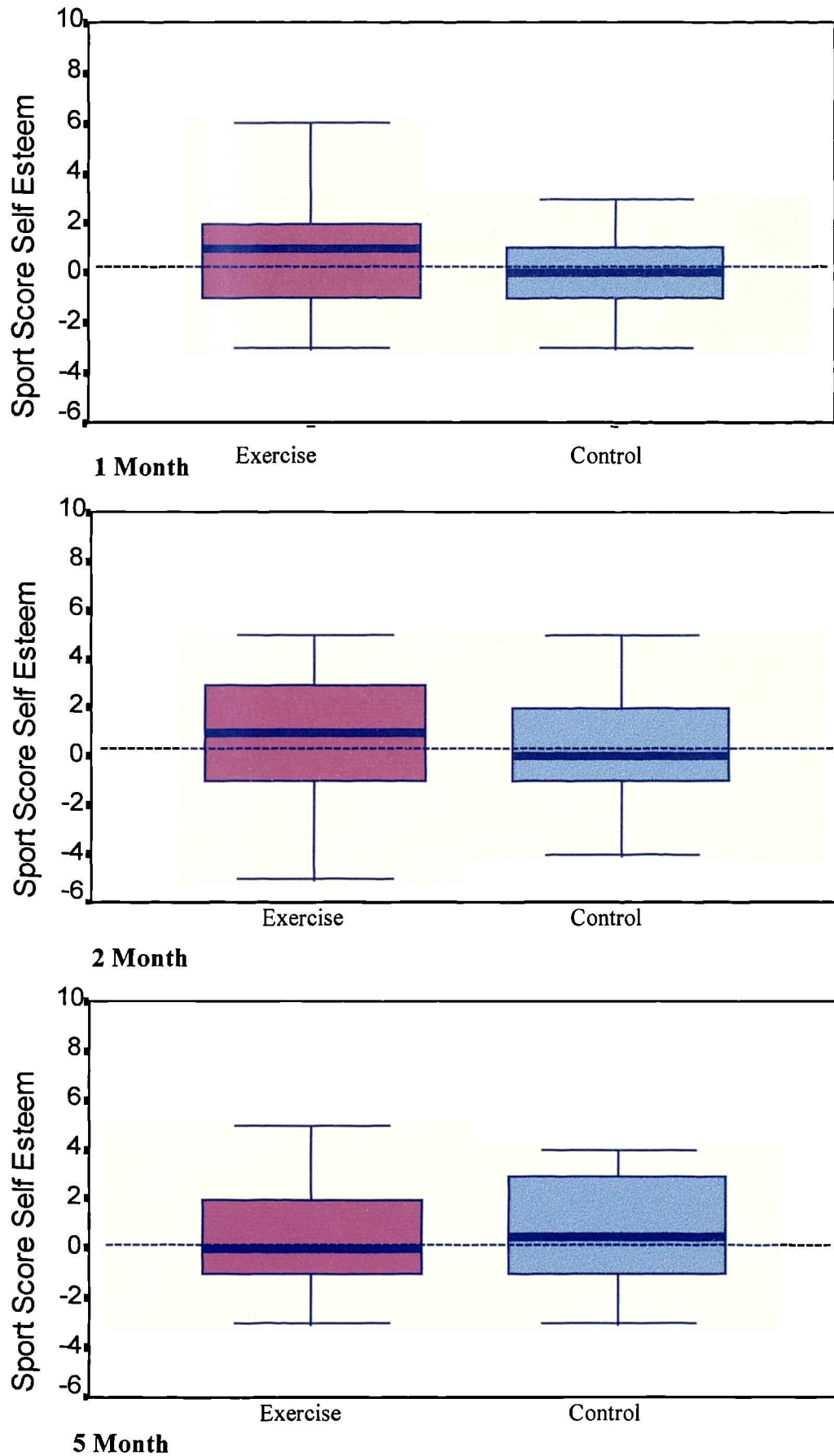


Figure 12 Median Changes, Quartiles, and Ranges in Sport Physical Self Perception

#### 4.2.4.5 Physical Self-Perception Profile - Condition

Mann-Whitney U tests were applied to compare change scores in physical self-perception in relation to body condition. Scores from baseline to one month, two month and five month between the exercise group and the control group are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 13.

##### **One month from baseline**

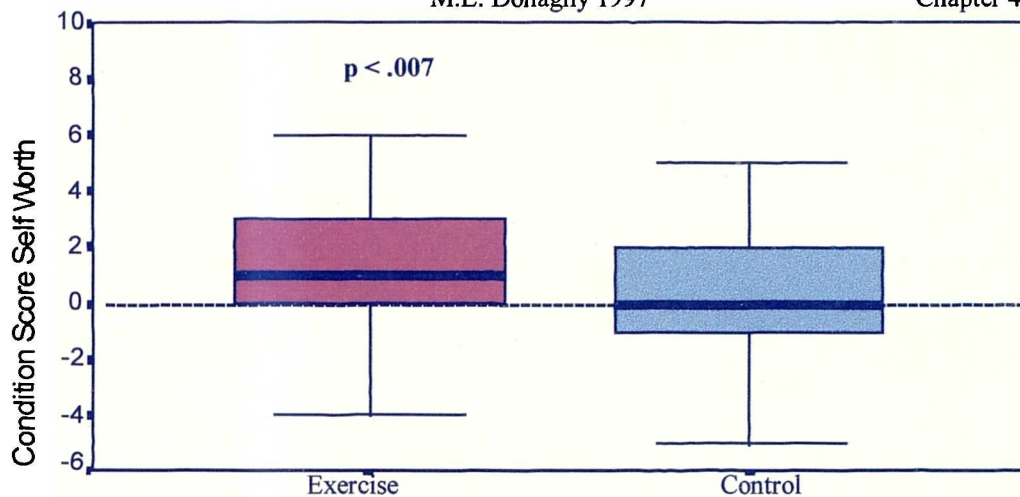
Mann-Whitney U

At one month from baseline the exercise group differed significantly from the control group, demonstrating a higher level of self-perception of body condition ( $p < 0.007$ ) (see table 12 and figure 13). The mean rank for the exercise group was 67.04 ( $n = 61$ ) and for the control group 50.24 ( $n = 56$ ). The results were found to be significant at  $p < 0.007$ ,  $U = 1217.5$ ,  $p = .0068$ . This means that the exercise group and the control group differ significantly in their perceptions of body condition at this time point.

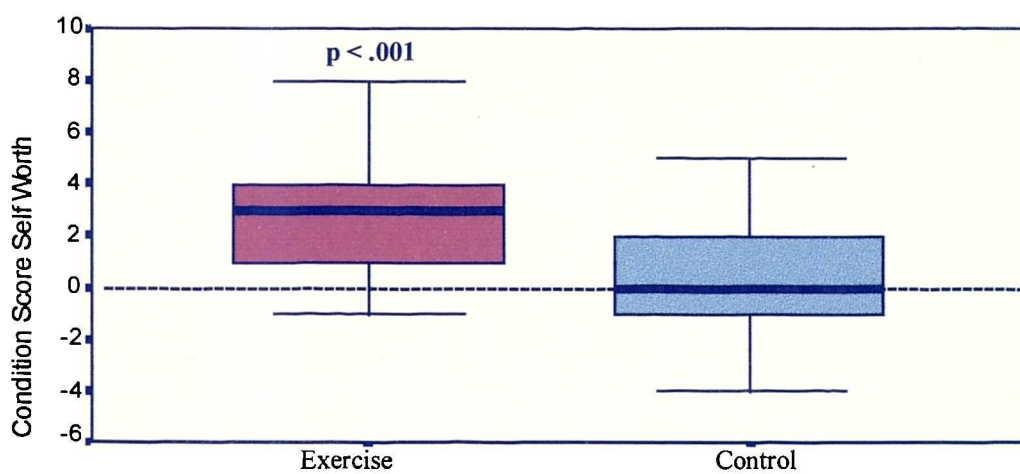
##### **Two month from baseline**

Mann-Whitney U

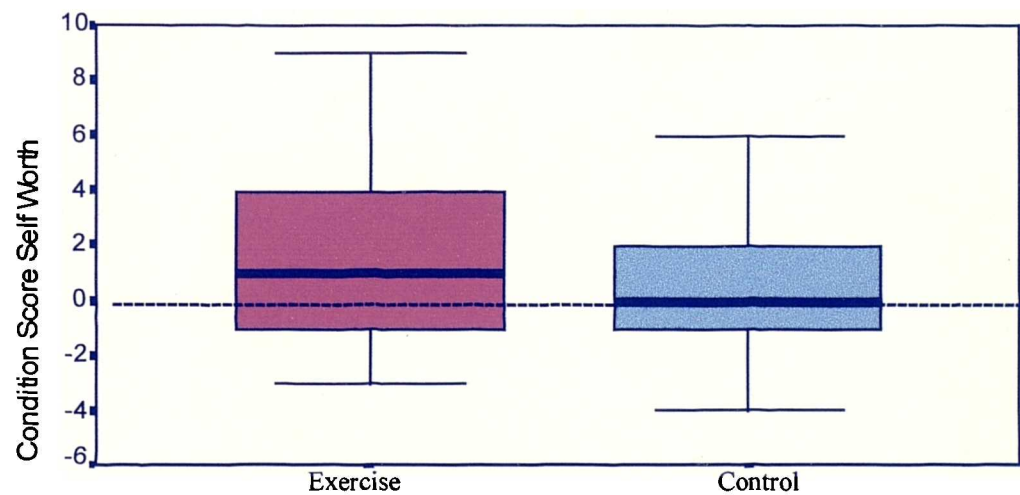
At two months from baseline the exercise group continued to have a higher self-perception of condition than the control group. ( $p < 0.001$ ) (see table 12 and figure 13). The mean rank for the exercise group was 42.26 ( $n = 37$ ) and for the control group 26.61 ( $n = 32$ ). The results were found to be significant at  $p < 0.001$ ,  $U = 323.5$ ,  $p = .0011$ . This means that the exercise group and the control group continue to differ significantly in their perceptions of body condition at this follow-up time point .



**1 Month**



**2 Month**



**5 Month**

**Figure 13** Median Changes, Quartiles, and Ranges in Condition Physical Self Perception

**Five months from baseline**

Mann-Whitney U

At five months from baseline the exercise group continued to maintain a level of improvement in the psychological measure of self-perception of condition although it was no longer at a significant level (see table 12 and figure 13). The mean rank for the exercise group was 24.73 ( $n = 22$ ) and for the control group 20.27 ( $n = 21$ ). The results were found not to be significant,  $U = 193.0$ ,  $p = .2475$ .

**4.2.4.6 Physical Self-Perception Profile - Body Attractiveness**

Mann-Whitney U tests were applied to compare change scores in physical self-perception in relation to body attractiveness. Scores from baseline to one month, two month and five month between the exercise group and the control group are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 14.

**One month from baseline**

Mann-Whitney U

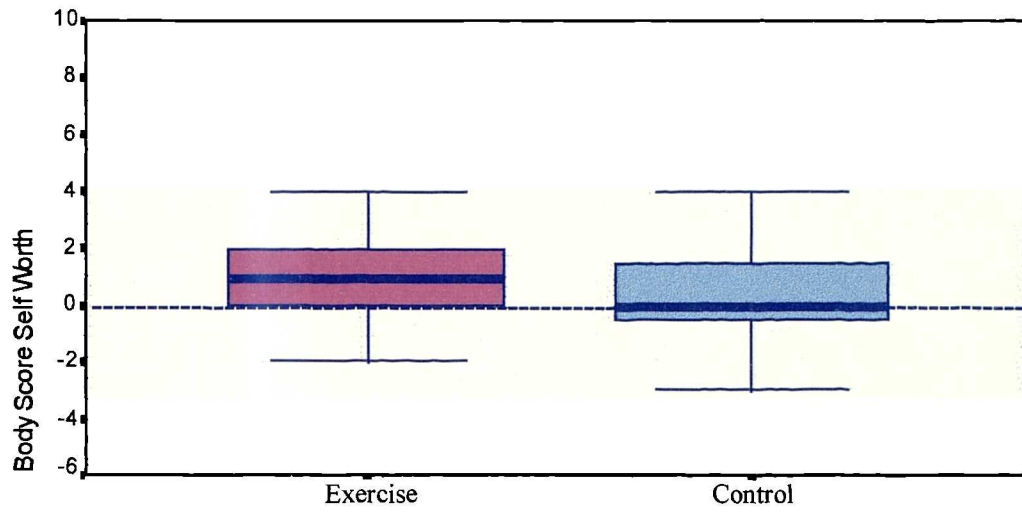
At one month from baseline, although the exercise group scored higher on body attractiveness, there were no significant differences between groups in the psychological measure of self-perception of body attractiveness (see table 12 and figure 14). The mean rank for the exercise group was 63.32 ( $n = 61$ ) and for the control group 53.15 ( $n = 56$ ). The results were found not to be significant,  $U = 1383.5$ ,  $p = .0994$ .

**Two months from baseline**

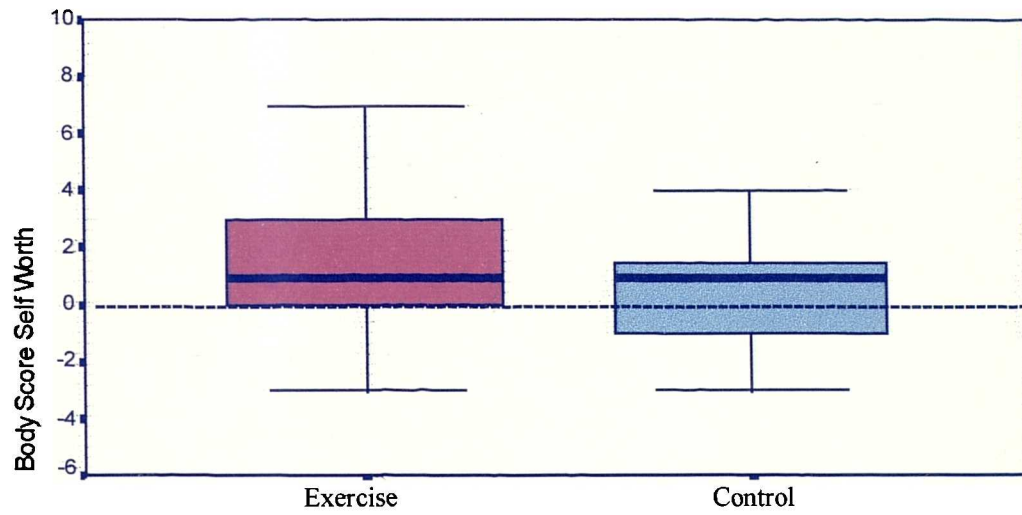
Mann-Whitney U

At two months from baseline the exercise group continued to have a higher perception of their body attractiveness than the control group but it was just outside a significant level (see table 12 and figure 14). The mean rank for the exercise group was 38.45 ( $n = 37$ ) and for the control group 29.79 ( $n = 32$ ). The results were found not to be significant,  $U = 427.5$ ,  $p = .0685$ .

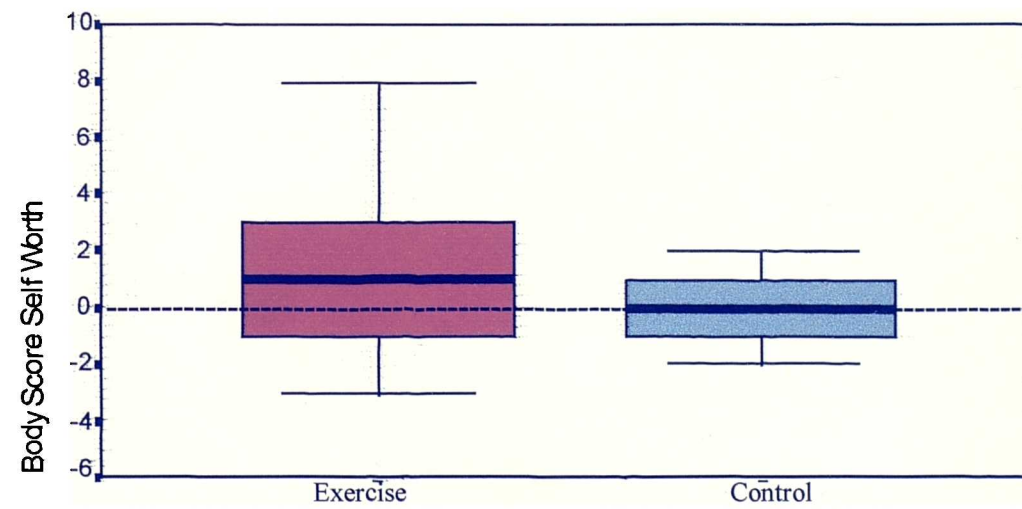




**1 Month**



**2 Month**



**5 Month**

**Figure 14** Median Changes, Quartiles, and Ranges in Body Image Physical Self Perception

### **Five months from baseline**

#### **Mann-Whitney U**

At five months from baseline there is no difference between groups in the psychological measure of self-perception of body attractiveness (see table 12 and figure 14). The mean rank for the exercise group was 23.65 ( $n = 22$ ) and for the control group 21.36 ( $n = 21$ ). The results were found not to be significant,  $U = 217.0$ ,  $p = .5523$ .

### **4.2.4.7 Physical Self-Perception Profile - Strength**

Mann-Whitney U tests were applied to compare change scores in physical self-perception in relation to perceived strength. Scores from baseline to one month, two month and five month between the exercise group and the control group are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 15.

### **One month from baseline**

#### **Mann-Whitney U**

At one month from baseline the exercise group perceived themselves as being stronger ( $p < 0.003$ ) (see table 12 and figure 15). The mean rank for the exercise group was 67.19 ( $n = 61$ ) and for the control group 48.86 ( $n = 56$ ). The results were found to be significant at  $p < 0.003$ ,  $U = 1147.5$ ,  $p = .0030$ . This means that the exercise group and the control group differed significantly in their perceptions of their own strength.

### **Two month from baseline**

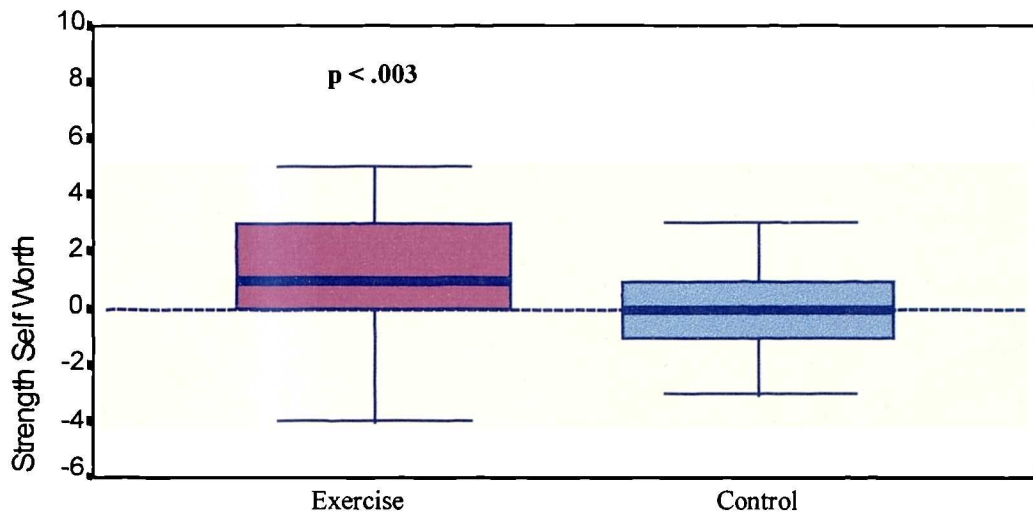
#### **Mann-Whitney U**

At two months from baseline the exercise group continued to demonstrate significant improvement in the psychological measure of perceived strength ( $p < 0.002$ ) (see table 12 and figure 15). The mean rank for the exercise group was 41.12 ( $n = 37$ ) and for the control group 26.60 ( $n = 32$ ). The results were found to be significant at  $p < 0.003$ ,  $U = 328.5$ ,  $p = .0024$ . This means that the exercise group and the control group continued to differ significantly in their perceptions of their own strength.

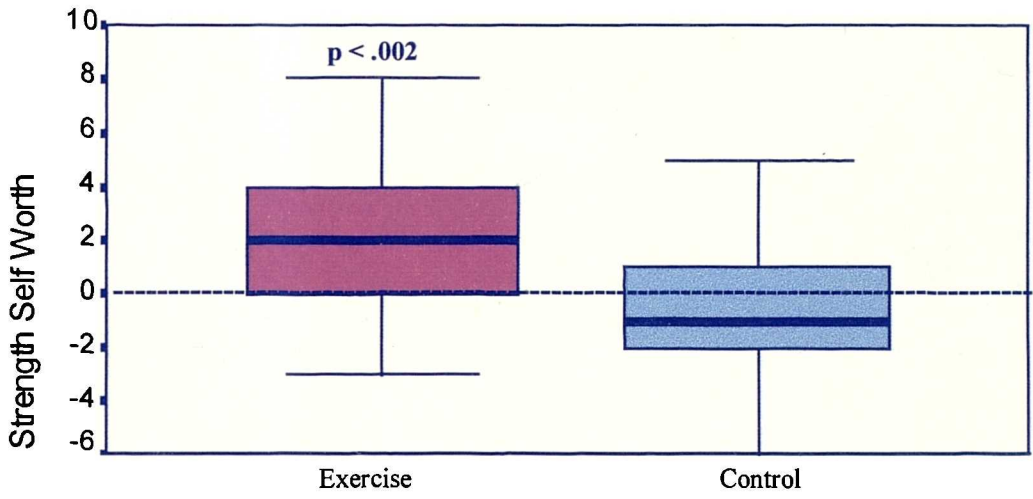
**Five month from baseline**

## Mann-Whitney U

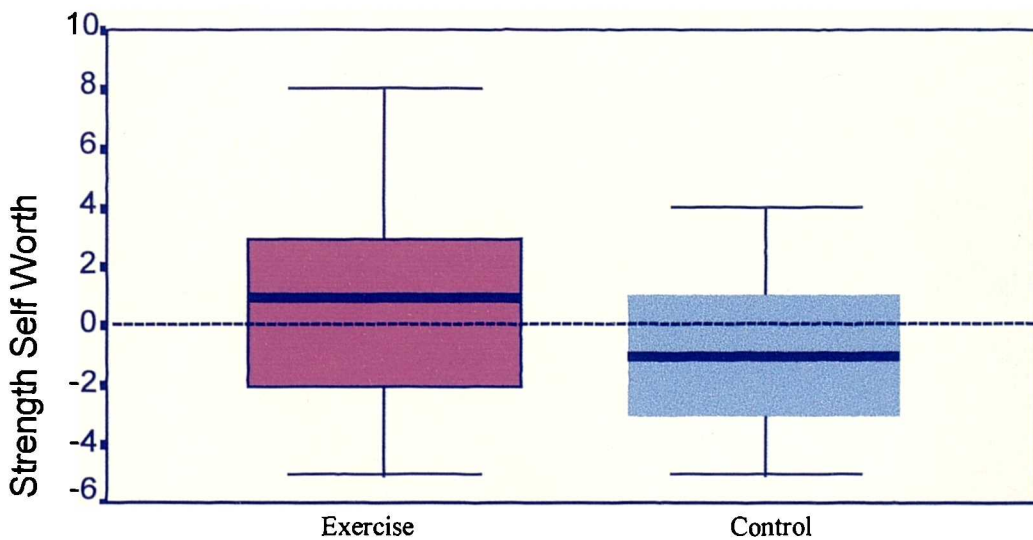
At five months from baseline the exercise group continued to score higher than the control group in the psychological measure of perceived strength although now there was no significant difference between the groups with the level just outside of significance (see table 12 and figure 15). The mean rank for the exercise group was 25.75 (n = 22) and for the control group 19.25 (n = 21). The results were found not to be significant,  $U = 170.5$ ,  $p = .0910$ .



1 Month



2 Month



5 Month

Figure 15 Median Changes, Quartiles, and Ranges in Strength Physical Self Perception

#### 4.2.4.8 Alcohol Dependency - SADD

Mann-Whitney U tests were applied to compare change scores in relation to alcohol dependence. Scores from baseline to one month, two month and five month between the exercise group and the control group on the SADD questionnaire are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in table 12 and in figure 16.

##### **One month from baseline**

###### Mann-Whitney U

At one month from baseline there was no significant difference between the groups in the measure of alcohol dependency (see table 12 and figure 16). The mean rank for the exercise group was 53.53 ( $n = 61$ ) and for the control group 64.96 ( $n = 56$ ). The results were found not to be significant,  $U = 1374.5$ ,  $p = .0683$ .

##### **Two month from baseline**

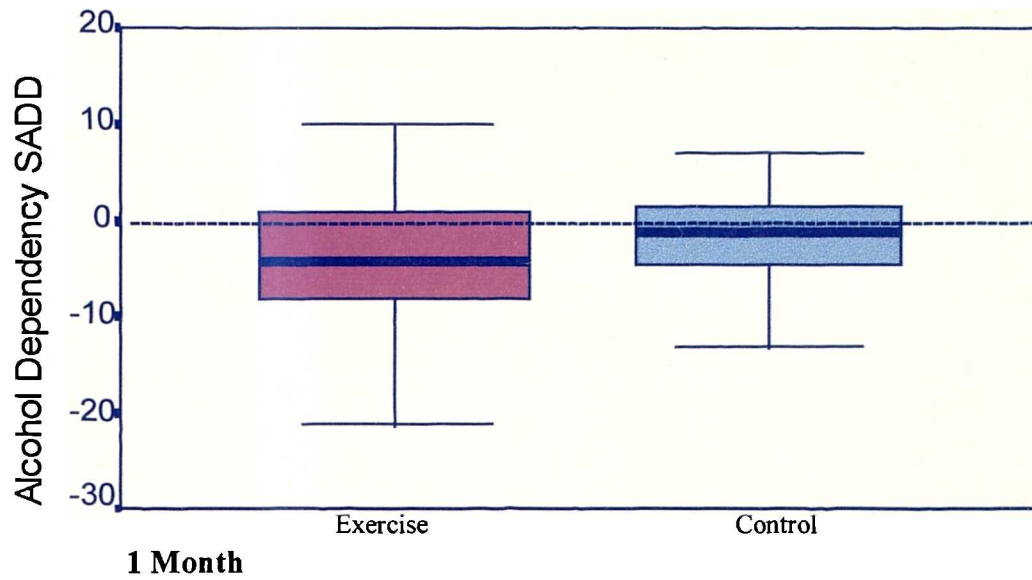
###### Mann-Whitney U

At two months from baseline there was still no significant difference between the groups in measure of alcohol dependency (see table 12 and figure 16). The mean rank for the exercise group was 31.77 ( $n = 37$ ) and for the control group 38.73 ( $n = 33$ ). The results were found not to be significant,  $U = 472.5$ ,  $p = .1499$ .

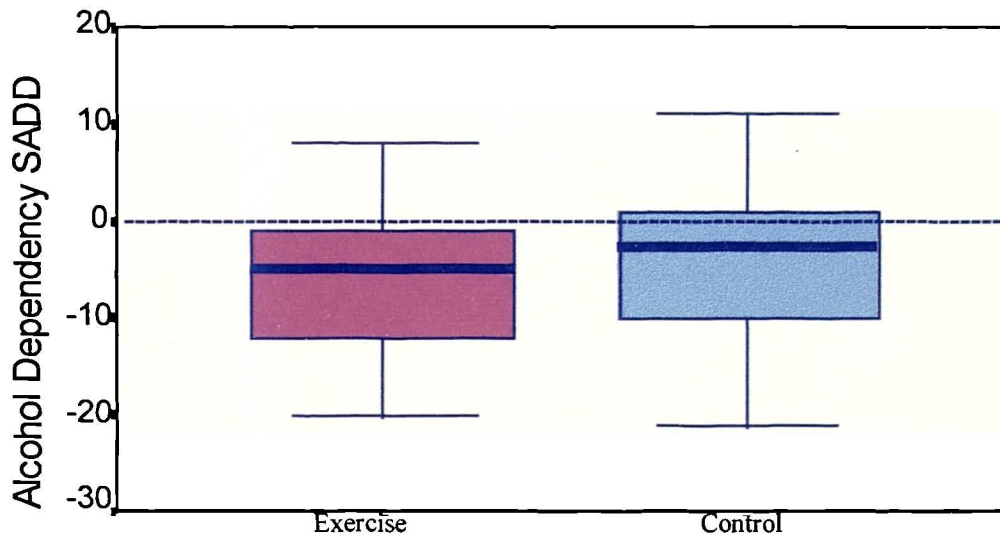
##### **Five months from baseline**

###### Mann-Whitney U

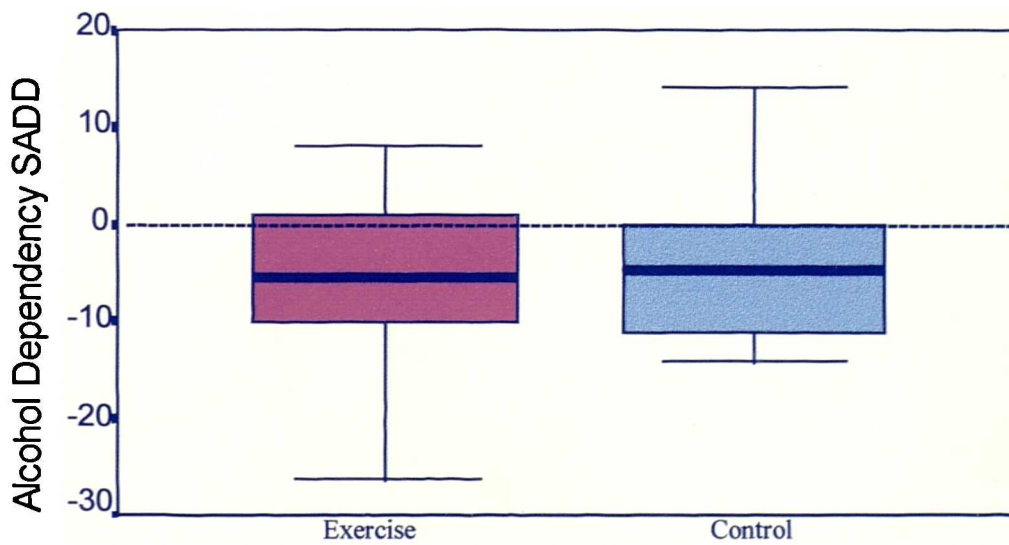
At five months from baseline there was still no significant difference between the groups in measure of alcohol dependency (see table 12 and figure 16). The mean rank for the exercise group was 22.30 ( $n = 22$ ) and for the control group 22.70 ( $n = 21$ ). The results were found not to be significant,  $U = 237.5$ ,  $p = .9157$ .



1 Month



2 Month



5 Month

Figure 16 Median Changes, Quartiles, and Ranges in Alcohol Dependency Scores

#### 4.2.4.9 Alcohol Consumption CDT - levels

Mann-Whitney U tests were applied to compare change scores in relation to alcohol consumption. Scores from one month, to two month and from one month to five months between the exercise group and the control group are reported. The median, quartiles and ranges for the changes from baseline to one month, two month and five month are shown in figure 17.

##### At Two months

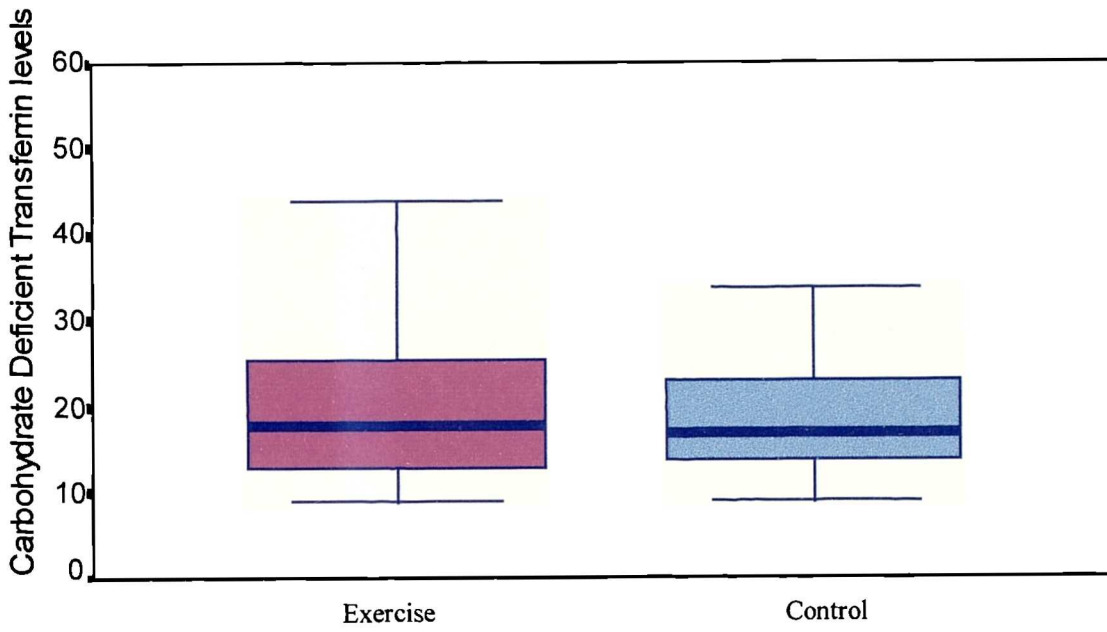
Mann-Whitney U

At two months the first CDT blood analysis was taken, there was no evidence of improved abstinence in the exercise group (see figure 17). The mean rank for the exercise group was 32.50 (n = 35) and for the control group 32.50 (n = 29). The results were found not to be significant,  $U = 507.5$ ,  $p=1.000$

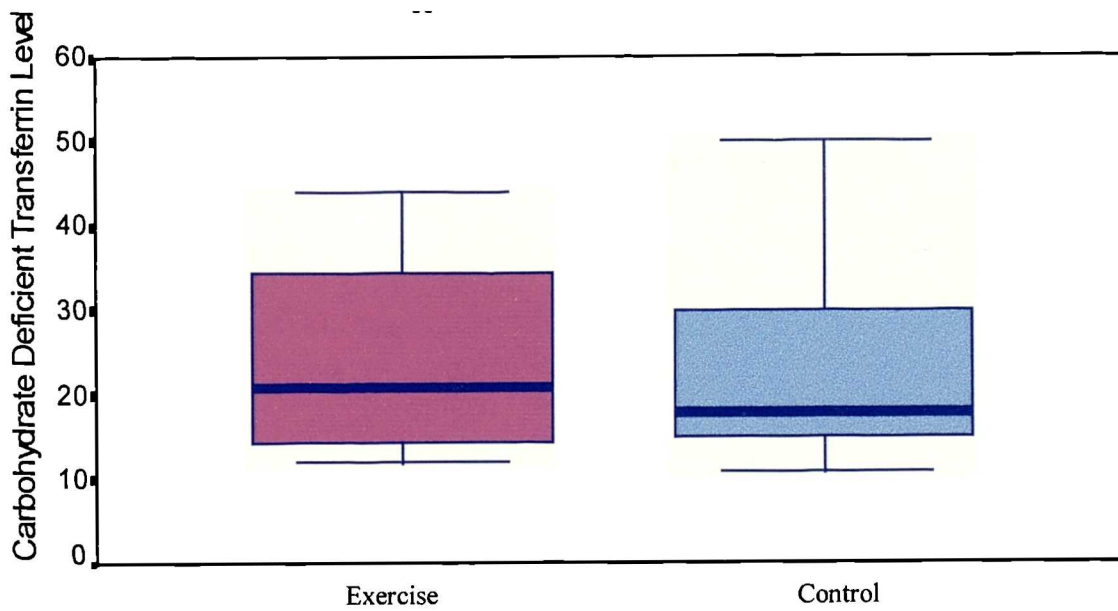
##### At five months

Mann-Whitney U

At five months the second CDT blood analysis was taken, there was no evidence of improved abstinence in the exercise group (see figure 17). The mean rank for the exercise group was 22.25 (n = 20) and for the control group 19.81 (n = 21). The results were found not to be significant,  $U = 185.0$ ,  $p=.5130$ .



**2 Month**



**5 Month**

**Figure 17** Median, Quartile, and Ranges of Carbohydrate Deficient Transferrin Levels



#### 4.2.4.10 Alcohol self report

Mann-Whitney U tests were applied to compare change scores in relation to self report on alcohol consumption. Scores from one month, to two month and from one month to five months between the exercise group and the control group are reported.

##### At two months

Mann-Whitney U

At two months the first self report on amount of alcohol consumed was taken, there was no evidence of improved abstinence between the groups. The mean rank for the exercise group was 32.57 (n = 37) and for the control group 37.81 (n = 32). The results were found not to be significant,  $U = 502.0$ ,  $p = .1765$

##### At five months

Mann-Whitney U

At five months the second self report on amount of alcohol consumed was taken, there was no evidence of improved abstinence between the groups. The mean rank for the exercise group was 23.30 (n = 22) and for the control group 21.70 (n = 21). The results were found not to be significant,  $U = 224.5$ ,  $p = .6536$ .

#### 4.2.4.11 Levels of drinking as indicated by blood analysis and self report

The manufacturers recommended cut off point of 20 U/l, CDT for males and 26 U/l, CDT for females was used which indicates an intake of 60 g / day of absolute alcohol over the past two weeks. This indicates alcohol consumption of more than 56 units a week. For self report the cut off point for relapse drinking was set at 56 units or more a week. Chi-squared and Fisher's exact tests were used to compare the number of subjects drinking at levels indicative of relapse. By comparing these results accuracy of self report can be compared with the CDT blood test.

The Chi-squared test was applied to determine the number of subjects in the exercise and control group who were drinking at levels indicative of relapse using the criteria identified above.

### At two months - drinking levels CDT blood analysis

#### Chi-Squared Test

There was no significant difference between the two groups on the number of subjects drinking above and below the limit as indicated by the CDT serum analysis.

( $\chi^2 = 8.780$ ,  $df = 1$ )  $p < .44$

69% of subjects were found to be drinking at levels below the relapse level indicating abstinence or controlled drinking . While 31% of subjects were drinking at levels above the cut off level suggesting they were in relapse drinking (see table 13).

	Number of subjects CDT levels over cut off point	Number of subjects CDT levels under cut off point	
exercise	11	24	35 54.7%
control	9	20	29 45.3%
	20 31.3%	44 68.8%	64 100%

**Table 13** CDT blood analysis cut off point for relapse drinking at 2 months

### At two months - self report drinking levels

#### Chi-Squared Test

There was no significant difference between the two groups on the number of subjects self reporting drinking above and below the cut off limit of 56 units a week

( $\chi^2 = 4.61$ ,  $df = 1$ )  $p < .20$

95% of subjects stated that they were drinking at levels below the relapse level indicating abstinence or controlled drinking . While 5% of subjects said they were drinking at levels above the cut off level suggesting they were in relapse drinking (see table 14).

	Number of Subjects over cut off point 56 Units or more	Number of Subjects under cut off point 56 Units or less	
exercise	2	35	37
			56.9%
control	1	27	28
			43.1%
	3	62	65
	4.6%	95.4%	100%

**Table 14** Self report in regard to cut off point of 56 units or more at 2 months

It can be seen from these two tables that self report of drinking behaviour and actual drinking behaviour as measured objectively by the CDT blood test are very different. These results suggest that 31% of subjects were drinking at levels of relapse and of those people 27% were under reporting on their drinking behaviour at this two month time point.

#### **At five months - drinking levels CDT blood analysis**

##### **Chi-Squared Test**

There was no significant difference between the two groups on the number of subjects drinking above and below the limit as indicated by the CDT serum analysis.

$$(X^2 = .58, df = 1) \quad p < .97$$

44% of subjects were found to be drinking at levels below the relapse level indicating abstinence or controlled drinking. While 56% of subjects were drinking at levels above the cut off level suggesting they were in relapse drinking (see table 15).

	Number of subjects CDT levels over cut off point	Number of subjects CDT levels under cut off point	
exercise	10	10	20 48.8%
control	8	13	21 51.2%
	18 43.9%	23 56.1%	41 100%

**Table 15** CDT blood analysis cut off point for relapse drinking at 5 months

**At five months - self report drinking levels**

Chi-Squared Test

There was no significant difference between the two groups on the number of subjects self reporting drinking above and below the cut off limit of 56 units a week ( $X^2 = 2.02, df = 1$ )  $p < .56$

91% of subjects stated that they were drinking at levels below the relapse level indicating abstinence or controlled drinking . While 9% of subjects said they were drinking at levels above the cut off level suggesting they were in relapse drinking (see table 16).

	Number of Subjects over cut off point 56 Units or more	Number of Subjects under cut off point 56 Units or less	
exercise	3	19	22 %
control	1	20	21 %
	4 9.3%	39 90.7%	43 100%

**Table 16** Self report in regard to cut off point of 56 units or more at 5 months

It can be seen from these two tables that self report of drinking behaviour and actual drinking behaviour as measured objectively by the CDT blood test are very different. These results suggest that at five months 44% of people were drinking at levels of relapse and of these people 35% were under reporting on their drinking behaviour at this five month time point.

#### **4.2.5 SUMMARY OF POST-TEST SCORES**

##### **One Month from Baseline**

At one month only the exercise group showed improvement in the physical parameters of aerobic fitness by estimated  $\text{VO}_2$  ( $p < 0.0001$ ) and in abdominal endurance strength ( $p < 0.008$ ).

There were also psychological improvements for the exercise group in physical self-worth ( $p < 0.02$ ), self-perceptions of condition ( $p < 0.007$ ) and perceived strength ( $p < 0.003$ ). There was no difference between the two groups in the reduction of anxiety and depression, although the change scores indicate both groups had a reduction on both these parameters. There was no difference between the groups on the physiological variables of flexibility, body weight or resting pulse.

Within group analyses using a Wilcoxon signed-ranks test was undertaken to establish whether the reduction in anxiety and depression was significant for both groups. This test indicated both groups had a significant reduction on both these parameters ( $p < 0.0001$ ).

##### **Two Months from Baseline**

At two months the exercise group were spending more time in physical activity than the control group ( $p < 0.02$ ) and were still physiologically fitter ( $p < 0.0001$ ), and still maintained improvement in strength ( $p < 0.0005$ ). The control group had lost weight ( $p < 0.04$ ). The psychological improvement in perceived strength ( $p < 0.002$ ) and condition ( $p < 0.001$ ) was also maintained while physical self worth was not.

Depression and Anxiety remained lowered for both groups, although there was no

significant difference between groups. The CDT blood test revealed no differences between groups. The chi-square analysis indicated that 69% were abstinent or in controlled drinking while 31% were drinking at levels associated with relapse. Only 4% of those in relapse self reported drinking at this level with 27% under-reporting on alcohol consumption.

Within group analyses using a Wilcoxon signed-ranks test was undertaken to establish whether the reduction in anxiety and depression was significant for both groups. This test indicated both groups had a significant reduction on both these parameters ( $p < .0001$ ).

### **Five Months from Baseline**

At five months from initial time of entry to the rehabilitation programme, many subjects had dropped out and the study lacked power to detect significant differences between the groups. At five months only fitness differed between the two groups with the exercise group maintaining improved aerobic fitness by estimated  $VO_2$  max. ( $p < 0.003$ ). The CDT blood analysis revealed that 56% of subjects were abstinent or in controlled drinking while 44% of the subjects were drinking at levels indicative of relapse. Of those people only 9% reported drinking at relapse levels with 35% under reporting on alcohol consumption.

## **4.2.6 ANALYSIS ADDITIONAL TO REQUIREMENTS OF THE STUDY**

### **4.2.6.1 Between site differences**

To explore any between site differences the Kruskal-Wallis test was applied to all variables. There were no significant differences between the sites. The difference in recruitment for each of the four sites is illustrated in table 17. Attrition rates from the study were compared to attrition rates from the in-patient and out-patient hospital programmes. In the year 1994, the in-patient alcohol treatment programme at Ailsa hospital had a drop-out rate of 18%. This low attrition rate was reflected in the study with 88% of those who joined the study completing the three week intervention programme. In comparison Gartnavel Royal an out-patient programme had a 50%

drop-out rate. This was also reflected in this study with only 47% completing the three week intervention programme.

#### **4.2.6.2 Variables indicating maintenance of abstinence**

In addition to the requirements of the study, further Mann-Whitney U tests were undertaken to see if any variables indicated maintenance of abstinence. At baseline, the only variable that indicated abstinence or levels of drinking below the cut off points was self perceptions related to body image. Subjects in the study who scored lowest on this dimension of self perception were more successful in maintaining abstinence or controlled drinking at both two months and five months ( $p < 0.003$ ). At one month, lower levels of depression indicated maintenance of abstinence or controlled drinking at two months only ( $p < 0.03$ ). Similarly, lower levels of anxiety at one month were associated with abstinence or controlled drinking at two months only ( $p < 0.005$ ).

#### **4.2.6.3 Associations between psychological and physiological variables.**

Spearman correlation coefficients were calculated between all physiological and psychological variables for both groups using a two-tailed test. In the exercise group, the following associations were found: improved fitness by estimated  $VO_2$  was correlated with improved condition ( $p < 0.02$ ) and with physical-self worth ( $p < 0.03$ ) at two months; and with improved condition ( $P < 0.05$ ) at five months. Physical strength and self-perceptions of strength were correlated at one month ( $p < 0.001$ ); at 2 months ( $p < 0.001$ ); and at 5 months ( $p < 0.001$ ). This suggests that increased fitness and strength relate closely to physical self perceptions.

#### **4.2.6.4 Variables indicating reason for drop-out.**

Mann-Whitney U tests were undertaken on the baseline data to see if any patient characteristics could be indicated as the reason for drop-out from the study. No significant difference was found between the 117 subjects who completed the intervention stage of the study and the 48 subjects who dropped-out of the study. The drop-outs include those who had baseline measures taken but dropped-out prior to the three week intervention programme. Two of the variables were close to

significance, age  $p < .06$  and the SADD  $p < .07$ , suggesting that the problem drinkers who were most likely to drop out were younger and that a perceived higher dependence on alcohol may also indicate withdrawal. The number of drop-outs from each of the four sites is indicated in table 17.



## Loudoun House Ailsa Hospital

Recruitment to study n =	Completers at 1 Month n =	Returners at 2 Months n =	Returners at 5 Months n =
88	76	43	23

## Gartnavel Royal Hospital

Recruitment to study n =	Completers at 1 Month n =	Returners at 2 Months n =	Returners at 5 Months n =
45	21	17	13

## Cameron House Crichton Royal Hospital

Recruitment to study n =	Completers at 1 Month n =	Returners at 2 Months n =	Returners at 5 Months n =
10	6	5	4

## Royal Edinburgh Hospital

Recruitment to study n =	Completers at 1 Month n =	Returners at 2 Months n =	Returners at 5 Months n =
22	14	5	3

## Total Number all Sites

Recruitment to study n =	Completers at 1 Month n =	Returners at 2 Months n =	Returners at 5 Months n =
165	117	70	43

**Table 17** Recruitment to study and number of completers by clinical site

## **CHAPTER 5**

### **DISCUSSION**

This chapter will discuss the findings of this study in relation to meeting the aims of the study and integrating the findings with current literature around the following six themes: physiological parameters; psychological parameters; the use of self report and objective measures of drinking; implications for treatment including attrition rates; further research and issues beyond the scope of this study.

#### **5.1 PHYSIOLOGICAL PARAMETERS**

On entry to an abstinence treatment programme, problem drinkers were found to have low levels of physical fitness. The findings of this study suggest that the inclusion of a three week exercise programme, in either an inpatient or outpatient abstinence treatment programme, does improve the physiological parameters of aerobic capacity and strength. Flexibility improved in both groups but there was no significant between group difference. By continuing to exercise with a twelve week home based programme, these improvements are maintained at the follow-up time points, with improved physiological fitness still maintained at five months after entry to the programme. In addition the exercise group spent more time in physical activity than the control group, as evidenced by the 7 day physical activity recall diary up to three months from entry to the programme. However this is not maintained beyond this time. Thus the aims of the study relating to the physiological parameters have been met with answers found in relation to the following: aerobic capacity; strength; flexibility and levels of physical activity.

The physiological improvements found in the exercise group brings much needed knowledge to this area of physiotherapy and sports and exercise science. The American College of Sports Medicine guidelines (1990) suggests that at least 6-8 weeks of aerobic activity undertaken 3 times a week with the heart rate maintained at between 65% - 75% of maximum is required to improve aerobic fitness. This study suggests that people with very low aerobic fitness, can improve their aerobic fitness by participating in a 3 week programme of exercise consisting of three 30-40 minute sessions, and that this improvement can be maintained for up to 5 months by participating in a twelve week home based programme. These results are based on physiological measures of estimated  $\text{VO}_2$  max. and until confirmed by maximum tests of aerobic fitness should be viewed with caution.

The results may be related to peripheral vascular changes and to structural alterations within the type IIa and IIb muscle fibres following the exercise programme. Damage to type IIb muscle fibres has been shown to occur with long term alcohol abuse (Peters et al., 1985). This will now be discussed in relation to physiological changes found in muscle biopsies of problem drinkers and cardiovascular changes associated with exercise. This will be followed by a brief discussion on the time period necessary for these changes to be evidenced. Finally this section will examine the relationship between this study and the existing research on exercise and problem drinkers.

Structural alterations have been found in the muscle fibres of problem drinkers. In a study of 151 problem drinkers admitted for alcohol re-education to a district hospital (Peters et al., 1985), skeletal muscle atrophy was found in two thirds of these patients. By undertaking quadriceps muscle biopsies it was established that the damage was to type II muscle fibres and that the type IIb anaerobic glycolytic fibres were predominantly affected. This atrophy appeared to be the result of direct effects of the alcohol on the muscle fibres themselves. Subsequent work by Martin et al. (1985) showed that on total abstinence of alcohol there was some recovery within three months and total recovery was possible in a year. Further work by Duane & Peters (1988) suggests that the reason

for the skeletal muscle deficit is due to a direct effect of the alcohol on muscle protein synthesis. Serum carnosinase activity was found to be significantly lowered in chronic problem drinkers compared to matched norms. Carnosinase is known to be a potent activator of certain key enzymes in skeletal muscle metabolism including myofibrillar myosin-adenosine triphosphatase.

In order to consider the implications of this damage to type II fibres, it is necessary to look at the biochemical adaptations in skeletal muscle induced by exercise training. Only by doing this can we then go on to consider the cardiovascular and peripheral benefits that may have occurred from a three week exercise programme, followed by a twelve week home-based exercise programme with this patient group.

Regular physical activity increases endurance capacity for submaximal work. Increased stroke volume and enhanced cardiac output and circulatory benefits have been associated with these changes. Biochemical changes within working muscles have also been associated with increased regular physical activity. This includes an increase in the content of mitochondria, the cellular organelle where energy adenosine triphosphate (ATP) is produced by the oxidation of fuels, glucose and fat, in the presence of oxygen (Terjung and Hood, 1986).

The intensity and duration of exercise influences the magnitude of this change, in mitochondrial content, in a complex manner. Not all skeletal muscle fibres may be recruited and consideration must be given to the differences in muscle fibre types. Mammalian muscle is mostly composed of three types as follows: type I slow-twitch red, this is relatively slow contracting and has a high mitochondrial content and endurance capacity; type IIa fast-twitch red which is relatively fast contracting with a high mitochondrial content and endurance capacity and type IIb fast-twitch white fast contracting with a low mitochondrial content and endurance capacity. These fibre types are recruited progressively as the intensity of exercise increases. In undertaking regular moderate intensity exercise you will increase the mitochondrial content of type I and type IIa fibres, this will enhance the capacity of the muscle to oxidise fat to energy thus

preserving the limited intermuscular glycogen store. The enhanced mitochondrial content and its related increase in fat oxidation will reduce fatigue and will improve endurance performance. The recruitment of type IIb fibres requires more intense exercise.

In summary the work of Terjung & Hood (1986) suggests that regular moderate exercise will increase the content of type IIa fibres enhancing the capacity of muscle to oxidise fat to energy thus preserving the limited glycogen store. The enhanced mitochondrial content will reduce fatigue and will improve endurance performance. The 3 week exercise programme undertaken in this study was of moderate to high intensity and is likely to have also involved recruitment of type IIb muscle fibres. Thus it would appear that participation in an exercise programme may be beneficial for problem drinkers by increasing chemical activity of the muscles countering some of the deficit encountered by the direct effects of alcohol on the muscle fibres. It will increase enzyme levels and this along with increased capillarisation (Saltin et al., 1965; Coyle et al., 1986) will enhance the capacity of the muscle to undertake work without fatigue. This may also account for the increased levels of physical activity found among the exercise group at the two and three month follow-up.

The cardio-vascular and respiratory changes associated with aerobic exercise include the following: thickening of the wall of the left ventricle and increased capacity of the left ventricle this improves cardiac output; there is an increase in blood volume and haemoglobin with an increase in stroke volume and a corresponding decrease in heart rate; the facilitation of oxygen delivery and thermoregulatory dynamics and increased oxygen extraction from circulating blood reduces systemic and diastolic blood pressure (American Heart Association 1992). The findings of this study in improved aerobic fitness are likely to be related to these cardio-vascular and respiratory changes, however this is not supported by a significant reduction in resting pulse. Exploration of the data suggests that the range of the scores related to this measure across the time points is more varied among the exercisers than the control group, with some of the exercisers showing a marked reduction in resting pulse.

One area of research that has looked closely at the cardiac and peripheral adaptations to exercise that occur over short periods of time has been in the effects of detraining, where normal activity is interrupted following injury. The research in this area suggests that regular aerobic activity undertaken over four weeks, following a period of detraining, has the potential to: improve estimated  $\text{VO}_2$  max.; increase muscle enzyme activity; increase blood volume; and increase cardiac output (Saltin, 1965; Coyle et al., 1985; Coyle et al., 1986). This is further supported by Hickson (1981) who suggests that aerobic fitness improvements of between 5% - 25% can be expected from participating in a three week training programme. Mutrie (1987) also found improvements in aerobic fitness following a four week exercise programme. Until now the existing research in the area of exercise as an adjunct to the treatment of problem drinkers has offered only limited support for these findings.

Gary and Guthrie (1972) found that a daily jogging programme improved fitness as measured by the Schnieder fitness test over a four week period. Palmer et al. (1988), however, incorporating an exercise programme based on the ACSM guidelines, and using the cycle ergometer test, found that the four week walking and jogging exercise programme with problem drinkers did not significantly improve estimated  $\text{VO}_2$  max. scores. In comparing Palmer's programme of exercises with this study and Gary and Guthrie the following differences are noted. There were differences in frequency, duration and intensity of the exercise programmes. Palmer et al. (1988) started with 20 minutes of exercise comprising of walking or jogging building up to 30 minutes of exercise three times a week over the four weeks. The intensity was said to be between 60% - 80% of estimated maximum heart rate. Gary and Guthrie (1972) don't indicate the time spent in exercise or the intensity but the frequency is greater at five times a week. In this study like Palmer et al. (1988) the frequency and the intensity followed the same ACSM guidelines, with problem drinkers in the study monitoring their own heart rate during activity. However the structured programme of aerobic activity and strength exercises in this study did target the moderate to higher end of the estimated maximum heart rate with intensities of 70%-75% being consistently targeted during

exercise sessions, this may have accounted for the differences in results. It seems more likely an explanation that the differences in findings between this study and Palmer's are due to differences in methodology. This study was a randomised controlled study with problem drinkers being recruited to the study across a calendar year, incorporating seasonal variations. In contrast the study undertaken by Palmer et al. (1988) was quasi-experimental with problem drinkers recruited to the control and experimental groups at different time points. Within these different time points there may have been several variables that could have influenced outcome, for example staff changes, peer influences, and seasonal activities.

Sinyor et al. (1982) found that a six week exercise programme with problem drinkers significantly improved aerobic fitness using the same outcome measure for aerobic fitness as Palmer et al. (1988) and this study. Sinyor et al. (1982) also found that participants in his study had low fitness levels on entry to the programme although their starting fitness levels were 10% higher than the subjects in this multi-site study. The fitness gains in subjects across the two studies was also similar. Other studies with problem drinkers that have found improved aerobic fitness have been over longer time periods and have used different outcome measures (Frankel and Murphy, 1974; Tsukue and Shohoji, 1981). Some of the earlier studies involved exercising over very long periods of time in some cases as long as ten months (Tsukue and Shohoji, 1981).

The time required to achieve physiological improvement is an important issue to inform current treatment intervention. At the time of this study (1993-1995) most alcohol treatment rehabilitation programmes undertaken in NHS trusts in Scotland were of three or four weeks duration. It was therefore important to demonstrate what improvements can be gained in this time period. The findings of this study indicate that problem drinkers have poor fitness levels when they come into a rehabilitation programme and that these can be improved over a three week period by participation in an appropriate exercise programme that follows the ACSM guidelines for exercise prescription. The effectiveness of following this up with a home based exercise programme can be evidenced by the maintenance of improved fitness up to five months

from the time of entry to the programme. In addition to being fitter the problem drinkers had improved strength as measured by muscular endurance and were more physically active. This may have implications for people returning to work, taking up everyday activities and making lifestyle changes from previous drinking behaviour.

These physiological benefits may reduce the risk of fractures and musculo-skeletal problems. It has already been established by Duane and Peters (1988) that damage to the type IIb muscle fibres is reversible following a period of ten months of abstinence from alcohol. What is still not known is whether regular exercise can speed up this recovery process. As previously stated in the literature review, problem drinkers are at risk of fractures due to the negative effects of alcohol on bone mass (Diamond et al., 1989; Rico, 1990, Jonsson et al., 1993). Several reviews have indicated that physical activity can enhance bone density (Marcus, 1992; Gannon, 1988), thus lending support for the inclusion of an exercise programme for problem drinkers followed by a home based programme, based on the evidence of increased levels of physical activity found in this study.

The twelve week home based programme was useful for increasing levels of physical activity for up to three months post entry to an alcohol rehabilitation programme. Suggesting that for the first eight weeks the home based programme had an effect in facilitating increased levels of activity this may partly account for the sustained increases in aerobic fitness found at five months. After this physical activity was not sustained at the same level. Although by this time the number of subjects dropping out of the study was increasing. Subjects returning at the five month recall when asked about adherence to the programme indicated that they had stopped using the home based programme before the twelve weeks recommended. Most subjects indicated adherence to the programme for between 6-8 weeks, with some continuing for 10 weeks. The reason for stopping was they felt they were now more active in everyday activities and were walking further and more frequently. Although this is not supported by their self report diary of activity. This could be due to failing to recall all times in walking that were longer than ten minutes. The results indicate that the home-based programme had the



greatest impact on activity levels for the first six weeks following the alcohol treatment programme.

This study found that fitness was associated with improved self worth, perceptions of improved condition and strength, although using different outcome measures these findings do support the earlier findings of Gary and Guthrie (1972) that self evaluation of the physical self improves with fitness. The importance of this in relation to self-efficacy and confidence to use exercise as a coping strategy will be discussed further in the next section, however this can be informed by the anecdotal reports of individual experience from problem drinkers in the study which will be discussed here.

The individual patient experience will now be considered. Problem drinkers are not a homogenous group as evidenced by the descriptive analysis of the data. Certain individuals in the study used exercise as a means of making significant lifestyle changes. Two of the subjects in the exercise group ran in half-marathons within four months from entry to the alcohol programme. Both of those people had previously regularly trained but had not done so for several years and both said they had lost confidence in their ability to get back into a training regimen. The exercise intervention enabled them to build their confidence again. They were both male one was aged 24 and the other 58 years, indicating that the exercise programme can be effective for a range of ages in developing self-efficacy and feelings of mastery.

Another young male of 21 years returned to training as a boxer after sixteen months out of the gym. One male of 52 successfully completed walking five Munros within the first three months from entry to the study. Again he had been a very keen hill walker but had not participated in this activity for several years while drinking. His comments again emphasised the confidence that he had achieved in participating in the exercise programme and that it gave him the motivation to set targets to get himself fitter. He found that weekly goal setting and participating in a daily strength and aerobic programme, and the reward of getting to the top of the Munro, was what had stopped him returning to drinking.

Several of the females in the study started attending aerobic classes and one female aged 42 started cycling to work and was maintaining this at five months. Most anecdotal reports were of increased activity in walking and this was also stated by people from the control group. Walking seemed to be an activity that most people found was a useful coping strategy in trying to cope with withdrawal from alcohol and the desire to return to drinking. However these successes have to be considered in context with the large number of people who dropped out of the study over time. In following these people up, through further recall appointments, and contact with key workers it was established in most cases that failure to attend for recall was due to them returning to problem drinking.

## **5.2 PSYCHOLOGICAL PARAMETERS**

The problem drinkers on entry to this study were found to have poor physical self-perceptions and low physical self-worth. In addition anxiety and depression levels were high and all subjects rated themselves as highly dependent on alcohol. The findings of this study suggest that the inclusion of a three week exercise programme, in either an inpatient or outpatient alcohol treatment programme, does improve the psychological parameters of physical self-worth, perceived physical condition and strength. By continuing to exercise with a twelve week home based programme, increased physical activity and improvements in perceived physical condition and strength are maintained at the two month follow-up but not at five months. There was no evidence that exercise can be linked to maintaining controlled drinking or abstinence, and although anxiety and depression was significantly lowered in both groups there was no evidence to attribute this change to the exercise programme.

Self-esteem has been extensively used as an indicator of emotional and psychological well being with low levels of self-esteem being evidenced among problem drinkers

(McMahon and Davidson, 1986). However, the existing literature shows only limited support for improved self-esteem following an exercise programme with problem drinkers. Gary and Guthrie (1972) found that self-esteem, as measured by the Jourard Body Cathexis index, improved along with fitness in a four week jogging programme. This was supported by the findings of improvement in self concept from a randomised controlled study which included a four week walking programme with inpatient problem drinkers (Whiting 1981, cited in Palmer et al., 1988). This finding, however, was not supported by Palmer et al. (1988) who failed to find any improvement in self-concept following their four week exercise programme using the same self-reporting measure as Whiting (1981). The limitations of the Tennessee Self concept measure which was used in both these studies has been highlighted previously in the methodology section.

Self-concept and self-esteem are often used synonymously and this can lead to confusion. Self-concept is more frequently defined as a self description, for example I am female, a mother and I provide for my children (Bernstein et al., 1994), where as self-esteem is the evaluative element of self-concept and relates to how one feels (Fox and Corbin, 1989). Recent self-esteem research has shown that self-esteem is a global construct underpinned by a multidimensional and hierarchical structure (Mutrie and Biddle, 1995). Global self-esteem comprises of self-perceptions relating to academic, social, and physical ability which are underpinned by perceptions of worth and competence. Perceptions of the physical self are viewed as being particularly important in self-esteem make up (Fox, 1990) and physical appearance has been shown to be one of the most dominant aspects of self-esteem throughout the lifespan (Harter, 1990). In this study physical self-perceptions were chosen as an outcome measure to enable the relationship between different facets of the physical self such as physical appearance and perceived physical skills such as strength to be explored. The inclusion of a three week exercise programme in an abstinence treatment programme does improve physical self-perceptions of physical self-worth, condition and strength with the latter two being maintained at the two month follow-up. These physical self-perceptions of worth and competence related to body condition and strength are part of the physical subdomain of global self-esteem (Fox and Corbin, 1989).

The findings of the study indicate low aerobic fitness and low self perceptions in problem drinkers who enter a rehabilitation programme and that both fitness and physical self-perceptions can be very quickly improved by the inclusion of an appropriate programme of exercises. It is not surprising that improved fitness relates closely to improved perceptions of condition and physical self-worth and that an improvement in actual physical strength is matched by improved perceptions of strength.

The finding of an inverse association between body image and maintained abstinence or controlled drinking brings potentially new knowledge into the area with regard to self-perceptions and body image. Suggesting that people with poor body image are more likely to be successful in their attempts to stop or control their drinking both immediately after discharge from a three week programme and also up to five months post entry. This could be an artefact of the study and this finding has to be treated with scepticism until further work is undertaken. It is however worthy of consideration alongside the research on psychological defence and negative expectancy in motivation (John, 1988; McMahon and Jones, 1993), which suggests that the person with an accurate insight into the way that alcohol has damaged their body and their appearance may be more highly motivated to change. The exercise programme may also be appealing to the person with poor body image who is motivated to change.

There is evidence from this study of an association between improved physical self-perceptions and improved physical fitness, suggesting that self-efficacy in relation to exercise will also be increased. This ability to successfully predict outcomes from exercise as an activity may be important in the ability to use exercise as a coping strategy and for changing lifestyle activities. The findings of this randomised controlled study, do not support that improved physical self-perceptions, physical activity and physical fitness will be associated with controlled drinking behaviour. These findings suggest that increased self-efficacy in relation to exercise may not, by itself, be an indicator of ability to use coping strategies to prevent relapse and that self-efficacy and motivation in relation to drinking behaviour need to be considered. Self-efficacy and motivation were

not directly measured in relation to exercise or in relation to drinking behaviour in this study, limiting the discussion, however the following points are presented for consideration.

Motivation in problem drinkers both during treatment and thereafter is heavily implicated in recovery (McMahon and Jones, 1992), with motivation being seen as being initiated revised and maintained through experience (Miller, 1983). It is generally agreed that positive expectations associated with drinking, lead to drinking behaviour, with less research focusing on the influences of negative expectancies leading to abstinence (Hansen, 1991). Marlatt and Gordon (1985) have been advocates of teaching coping skills to increase self-efficacy stating that drinking is most likely to occur where cognition associated with positive outcomes from drinking outweigh the ability to use alternative coping strategies in high risk situations. Marlatt and Gordon (1985) call this the abstinence violation effect. Strategies include identifying high risk situations; modifying cognition associated with positive outcomes of drinking; developing more balanced lifestyle to decrease frequency with which high risk situations occur. Positive expectancies include tension reduction; increased camaraderie, social assertiveness and power (McMahon and Jones, 1993).

There is evidence to support that positive expectancies related to drinking represent motivation to drink (Brown et al., 1987). This implies that the goal directed behaviour, to attain the perceived benefits, could be replaced by other goals such as the reduction of tension and increased camaraderie through exercise rather than drinking. This may seem a useful model, and one that was applied in regard to this study, however the model seems to have several weaknesses. The link between using exercise as a coping strategy and integrating this into cognitive coping statements relating to high risk situations was not undertaken. The importance of this link was not considered in planning the study. The other point is that it requires high levels of motivation to consider undertaking an activity such as participation in exercise to reduce tension when a similar effect can be more quickly realised through drinking.

In this study there is evidence that the problem drinkers were motivated to participate in the exercise programme. The adherence to the home based programme appeared to be good in the short term, however motivation to continue to the end of the twelve weeks was poor. Anecdotal reasons for this have been reported, however it may be important for future studies to consider motivation and the use of exercise as a coping strategy in relation to positive and negative expectancies relating to drinking behaviour. This may allow a greater understanding of the best way that strategies such as exercise can be integrated into programmes taking account of the need to modify cognition in high risk situations. The links between exercise and cognitive mood states of anxiety and depression were also explored in this study.

Both the exercise and control group had significantly lower levels of anxiety and depression at the end of the three week alcohol treatment programme. This suggests that the alcohol rehabilitation programmes attended by the participants in this study may have been successful in reducing anxiety and depression. The treatment programmes, from which the subjects were drawn, all had group sessions in the management of anxiety and depression which included using behavioural and cognitive approaches. The reduction from moderate to high levels of anxiety and depression observed at baseline to being asymptomatic suggests that other intervention strategies were effective. Whether the exercise had any effect over and above this effect is concealed by the floor effect in the reduction of these symptoms. Another explanation could be that the intervention used for the control group, a programme of gentle stretching and breathing exercises, had the same effect as the exercise group in reducing these symptoms.

A reduction in anxiety and depression has been found in other exercise studies undertaken with problem drinkers. The work of Palmer et al. (1988) supports the earlier findings of Frankel and Murphy (1974), suggesting that trait and state anxiety and depression are significantly reduced during exercise. Their findings suggest that problem drinkers who undertake an aerobic exercise programme will be better able to cope with life-stresses on discharge from the alcohol treatment programme. In considering these findings in relation to the findings of this study there are important

differences in design and methodology. Neither of the other two studies were randomised controlled trials. Frankel and Murphy had no control group and the control group in Palmer's study was taken at a different time point from the experimental group. The findings in their studies in regard to anxiety and depression could be as a result of experimental bias, peripheral effects of time spent with the therapist, effects over time, or the effects from other therapeutic intervention. In the Palmer study the two latter are less likely to have occurred as the inclusion of a control group should have eliminated these effects.

Although moderate to high levels of both anxiety and depression were recorded at baseline in this study using a well validated standardised self reporting instrument, none of the subjects had been given a clinical diagnosis of depression or anxiety. Thus the clinical relevance of this reduction in anxiety and depression across both groups in regard to improved quality of life and an increased ability to cope with life stressors is not clear.

The findings of this research with problem drinkers can be considered alongside the work undertaken by Martinsen et al. (1985; 1989a; 1989b) with subjects who had a clinical diagnosis of depression and anxiety. The findings of Martinsen's work suggests that exercise is effective in the treatment of depression and anxiety although the strength of these findings are limited as none of the studies (Martinsen et al., 1985) included a no treatment control group.

The results of this well designed study however, does bring new knowledge to this area of the literature suggesting either of the following: the therapeutic intervention in all of the four alcohol treatment programmes, included in this study, was effective in reducing anxiety and depression among the problem drinkers who participated in this study; or that both the exercise group and the placebo control exercise programmes were effective in bringing about a change in these mood states. Further research is needed to clarify which explanation is the most likely.

The participants in the study did indicate that they enjoyed the gentle stretching and breathing exercise group and it was perceived as being beneficial. Only two subjects withdrew from the control group and the study, to enable them to participate in more active exercise. Thus it may have acted as a powerful placebo or the stretching and breathing may have had short term benefits of lowering pulse rate and respiratory rate inducing physiological relaxation. There was no evidence of this in the long term as measured by resting pulse and heart rate. Further research is required to test out these explanations.

### **5.3 SELF REPORT AND OBJECTIVE MEASURES OF DRINKING**

Previous research in this area suggested that exercise could be linked to sustained abstinence up to three months post discharge from an alcohol treatment programme (Sinyor et al., 1982). However the methodology of that study was quasi-experimental and abstinence was measured by corroborated self report. In contrast, this study adopted a more robust methodology and used a laboratory benchmark to indicate abstinence. The findings of this study suggest that an exercise programme undertaken as part of an alcohol treatment programme and followed up by a home exercise programme does not improve the likelihood of problem drinkers maintaining either abstinence or controlled drinking. Similarly there is no indication that improved physical fitness and self esteem is linked to maintaining abstinence or controlled drinking.

These findings challenge the report by Sinyor et al. (1982) who suggested that enhanced fitness may enable problem drinkers to deal more effectively with emotional stress. Reducing the likelihood of resorting to drinking when faced with conflict. He also suggested that participation in a regular exercise regimen may promote the reorganisation of leisure time and the ability to make changes in other areas of lifestyle. The latter statement can be supported by the evidence from this study but not the link with abstinence.



It is not clear from Sinyor's report if abstinence was the only goal of choice. In this study the alcohol treatment programmes across the four sites allowed the problem drinkers to decide whether their long term goal was abstinence or controlled drinking, the short term requirement at all sites being abstinence. Each person was given counselling regarding their suitability for such choice, the advice being based on history of drinking behaviour, previous admissions and treatments, and risks in regard to current health. The difference in outcomes from the two studies may be related to the therapeutic content of the alcohol rehabilitation programme or the accuracy of the outcome measures.

In this study an objective measure of alcohol consumption was included along with self report. No previous study of exercise and problem drinkers has included an objective marker as an outcome measure. Serum carbohydrate deficient transferrin (CDT) is a marker of chronic alcohol consumption increasing above normal in healthy individuals after a daily intake of more than 60g of ethanol alcohol over a time period of more than two weeks. It has been found to have a high level of sensitivity (88%) and specificity (82%) for recent alcohol abuse (Radosavljevic et al., 1995) and has been said to be the best marker for monitoring abstinence or controlled drinking in problem drinkers (Salmela et al., 1994). Sillanaukee (1996) suggests that the fact that the CDT value seems to increase after 10 days of drinking at levels of between 50g and 80g of ethanol per day, makes it a good marker for routine work in detection of alcohol abuse and for monitoring abstinence or relapse.

CDT, like other laboratory markers, is capable of producing false positives. The quality control laboratory results indicate that there will be a few patients where  $\pm 2$  U/l may introduce the concept of borderline or suspicious results. False positives have also been found to be associated with a rare genetic variant affecting glycoprotein, malignancy, chronic hepatitis C and primary biliary cirrhosis (Sillanaukee, 1996; Bisson and Ward, 1994). Patients with liver disease currently abstaining from alcohol have been found to have normal CDT values (Stibler and Hultcrantz, 1987).

CDT as a marker to detect chronic alcohol consumption is not without its critics. Ongoing research in Japan suggests that CDT is a marker for alcoholic liver disease rather than for alcohol consumption (Takase et al., 1985; Matsuda, et al., 1991; Tsutsumi et al., 1994) The reliability of CDT as evidence for chronic alcohol abuse where there is chronic liver disease has also recently been questioned in a study involving patients in a renal unit (Radosavljevic et al., 1995). However no significant correlation was found between CDT values and severity of liver disease with high and low CDT values found to be present in patients with liver cirrhosis (Lesch et al., 1996). Interestingly in the same study Lesch et al., (1996) found that there was no correlation between CDT values and extent of acute alcohol intoxication. With some patients having CDT values in the normal range despite high levels of alcohol consumption. There is a need for further research and clarification of these issues.

Taking account of these criticisms, the overall evidence from current clinical biochemistry research still suggests that CDT is currently the best marker available to indicate chronic alcohol consumption (Salmela et al., 1994; Bisson and Ward, 1994; Borg, 1993; Sillanaukee, 1996, Sillanaukee et al., 1992; Stibler et al., 1991; Gjerde et al., 1988). With CDT having been found to indicate relapse before self-report (Rosman et al., 1995).

In comparing the findings from this laboratory bench mark to the self reports of drinking behaviour we see that there is no association. The people who participated in this study greatly under reported their drinking behaviour. At two months the CDT serum analysis indicated that 31% of those returning to follow-up, were drinking at daily levels in excess of 60g of ethanol alcohol. This level is indicative of relapse into chronic alcohol drinking. Of those people 27% in their self report of daily units of alcohol consumed, stated that they were drinking at levels below this. Similarly at 5 month follow-up 44% were indicated as being in relapse with 35% under reporting.

These findings challenge the accuracy of the reporting method used in Sinyor's study. The evidence from the literature lends some support for the reliability of using

corroborated self report of drinking behaviour (Maisto et al., 1985; Zweben, 1986). However under reporting of alcohol consumption is also frequently found (Stibler, 1991; Sillanaukee et al., 1992; Schellenberg et al., 1989). The evidence from these studies and this one questions the findings reported by Sinyor et al. (1982) in relation to maintained abstinence. The only other study linking a reduction in alcohol consumption to exercise has been undertaken with college students who were heavy social drinkers Murphy et al. (1986). Alcohol consumption was measured by self report which was not corroborated, although the authors did attempt to reduce under reporting by including reporting of alcohol consumption in a daily journal which also recorded a number of other behaviours.

The evidence from this randomised controlled trial using an objective marker, CDT serum analysis, suggests that exercise can not be linked to maintaining abstinence levels and challenges the existing knowledge in this area.

#### **5.4 IMPLICATIONS FOR TREATMENT**

The findings from this study may be of interest to health service managers, policy makers service providers and physiotherapists, as it informs them of the poor fitness levels and low physical self-perceptions among problem drinkers. Improvement in fitness, strength and physical self-perceptions can be achieved during a three week treatment programme with benefits maintained by including a home based exercise programme. In the current health care climate, programmes may not continue, where there is not the research to support them (Chick, 1995). Systematic reviews based on randomised controlled trials or evidence from randomised controlled trials are needed to inform the most appropriate treatment programmes. To the author's knowledge, this study is the only randomised controlled trial which has looked at the effects of exercise and has included follow-up data up to five months post entry to the programme, as such the findings are of interest.

In considering the cost effectiveness and viability of programmes, service providers require to look closely at the content, delivery and outcomes. The findings of this study

indicates that within the four sites the psychological and physiological benefits and problems of maintaining abstinence or controlled drinking are similar whether the delivery of the programme is inpatient or out-patient. Geographical locale, whether city or rural, does not appear to influence the outcome of treatment.

There is also the potential that increased physical activity will reduce the risk and incidence of fractures and will reduce muscle fatigue and soreness encouraging activity and improving quality of life. Physical self-worth is also improved with increased physical self-perceptions relating to body condition and strength. Anxiety and depression was reduced in both groups although it is likely that this was due to other therapeutic intervention in the programme and there is no evidence to suggest that exercise was responsible for this. The subjects in the study reported satisfaction with their exercise intervention programme and found the workbook containing the home based programme easy to follow. None of the subjects reported any injuries as a result of exercising.

On discharge from the treatment intervention programme the participants in the study were asked by the main researcher about their views in participating in the classes. The majority of the problem drinkers in the exercise group reported that they felt more confident about participating in regular exercise. This was evidenced in the 7 day physical activity recall sheets, by a small number who made use of their local health and fitness facilities. Some also made use of facilities such as multi-gym's in support centres run by volunteers for problem drinkers. Most of the participants in both groups stated that they found the classes enjoyable and fun. In addition, the control group stated that they found the sessions relaxing, while the exercise group used words to describe their experience as making them feel more alert, felt it was doing them good, made them feel good about themselves, and feeling fitter.

There is a need for physiotherapists to consider the issue of adherence, as it was evident from the monthly physical activity 7 day recall diary that the 12 week home based programme was only effectively followed for the first 6-8 weeks. After this time interest

in the programme and motivation to continue was greatly reduced. Many reported that they felt they no longer needed to follow it as they were now more physically active in everyday activities. Many indicated that they were *walking further and more frequently*. This was borne out by others in the study as they often met each other when out walking particularly in the sites in the rural areas of Ayrshire and Dumfries. However, it was evident by 5 months that although the exercise group were still more active than the control group they had not maintained the same level as in earlier months.

Motivation to follow treatment regimens including exercise prescription is likely to be influenced by treatment preference (Brewin and Bradley, 1989) so encouraging patients to make choices in selection is important. That is why within the three week intervention two sessions were supervised and the other session was an activity which was unsupervised. These sessions included badminton, weights, using gym equipment for rowing, cycling, and walking. The home based programme although including prescribed exercises also encouraged personal choice in activities. However further support in encouraging patients to join activities available locally may be required

Giving patients more autonomy in the choice of treatments as advocated by Martha Sanchez-Craig (1990) and is currently influencing programme planning. However within this the benefits of group exercise activity which is a cost effective treatment approach should not be discarded for an individualised programme of activity for every patient. Group exercise sessions, such as the one used in this study, are designed to meet the needs of individuals with different fitness levels. Patients should be informed of the physical and psychological benefits of undertaking a programme of exercise, and taking account of resources, the appropriate range of options for participation in activities should be given.

Strategies for increasing adherence could include follow-up telephone support (once a fortnight) to see what goals have been achieved and which new ones are being set. Return visits for fitness testing, at appropriate intervals. Linking with key worker to see what local facilities are available that the person may wish to access. Discussing with

patients before discharge the kinds of activities they may wish to try and that are accessible to enable them to continue with physical activity.

#### **5.4.1 Attrition Rates**

There was a drop-out rate of 26% at 1 month from the study, and all of those who dropped out of the study also dropped out of the treatment programme. In addition to this problem drinkers on the treatment programme who had not volunteered for the study also dropped-out. This is an issue common to all alcohol treatment programmes with drop-out rates of 50% frequently reported (Stark, 1992; Beckman and Bardsley, 1986). The drop-out rate continued over the follow-up period with a further 30% failing to attend for recall at 2 months and of these returnees a further 17% failed to attend at 5 months. The high number of returnees to clinics is well documented. Recent statistics suggest that of 2,583 males and 982 females admitted to alcohol clinics across Scotland, only 840 males and 340 females were new admissions (Scottish Health Statistics, 1993).

Current research has failed to find characteristics in regard to age, sex, and socio-economic factors that will consistently predict increased attrition rates (Stark, 1992). There is some evidence to support that clinical depression is more frequent in those who withdraw from alcohol treatment (Beckman and Bardsley, 1986), and a correlation between greater degree of alcohol use and drop-out has been indicated (Stark and Campbell, 1988). The findings of this study did not find support for either of those findings, although there was some indication of increased attrition among younger attendees and problem drinkers who had high scores on the severity of dependence measure, these differences were not significant. Stark (1992) suggests that future efforts to reduce drop-out rates should focus on the characteristics of the treatment programmes rather than on the characteristics of the patients those programmes treat.

Relapse and the low success rate of treatment programmes is an issue constantly under review (Chick, 1995) with ongoing research looking for cost effective treatment options (Graham et al., 1996). Marlatt and Gordon (1985) suggest that relapse is likely

to occur where positive expectancies about the effects of alcohol are linked to low self efficacy for coping. Treatment focuses on teaching problem drinkers to identify high risk situations, to develop and implement coping skills including modifying cognition. These skills include developing a more balanced lifestyle to decrease frequency with which high risk situations occur.

The early findings from the acamprosate trials in the USA indicate that this may be a useful drug in the treatment of problem drinkers (Chick, 1995). Clinical trials are currently taking place in the UK, with preliminary results to be published by the end of 1997 (personal contact National Addiction Centre London). It is envisaged that the effectiveness of this drug in reducing craving for alcohol will enable problem drinkers to be more motivated to change their lifestyle and previous drinking behaviours. It is recognised that the drug itself is not the answer to changing behaviour but may assist the change process. Adherence to exercise programmes may be enhanced by people taking this drug.

## **5.5 ISSUES BEYOND THE SCOPE OF THIS STUDY**

The complexity of physical, psychological and social problems associated with problem drinking means that there were many extraneous variables, particularly after discharge from the programme, that may have compromised the results of this study.

The poor success rate of treatment programmes and high attrition rate of all intervention studies with this population accounts in part for the high drop-out rate from this study. Repeated attempts to track and recall non-returnees were impeded by problems associated with returning to problem drinking, such as changing address, and loss of contact with key worker.

It was not possible within the scope of this study to fully establish content validity of the Physical Self-Perception Profile, although the author's instructions were followed to establish content validity with a small sample of problem drinkers.

The 7 day physical activity recall may have contained inaccuracies. The problem drinkers were given instruction and training, by the physiotherapists on site, detailing what activities to include and how to report activities in units of time. Three 7 day recall forms were completed, one each week, while in the alcohol treatment programme. However the accuracy of the form is dependant on accuracy of recall particularly in relation to amount of time spent in activity. A more accurate method of recording aerobic activity would have been by measuring heart rate activity through a sports tester and downloading this information on to a computer, however this was beyond the scope of the resources of this study, and would not have recorded all physical activity.

The timeline method of self reporting drinking behaviour also depends on accuracy of recall. As the CDT marker indicates regular heavy consumption of alcohol over a period of 10 - 15 days, it may have been more appropriate to have self reported drinking behaviour over this length of time rather than limiting it to 7 days. Although this is unlikely to have made any difference to the results as the CDT levels increase after 10 days with an intake of 60 g of ethanol or more per day.



## CHAPTER 6

### CONCLUSIONS

The long history of medical and social problems, and the costs in relation to health and industry, has not led to effective treatment for the majority of problem drinkers. This does not appear to be due to a lack of resources but rather as the result of the multifarious nature of the problem and the difficulties associated with changing behaviour. This study has highlighted the multiple aetiological factors that may predispose, trigger and maintain problem drinking. The research that has been evaluated in regard to treatment outcomes suggests that it is unlikely that any one treatment will meet the needs of all problem drinkers. There is a need for programme planners and researchers to continue to look for new approaches that may be beneficial in the treatment and rehabilitation of the problem drinker. It is important to know the effects of any treatment intervention in relation to the physiological, psychological and sociological benefits. This study set out to do this in relation to the effects of undertaking a regular exercise programme both during the intensive treatment phase and in the post-discharge period following the intervention programme.

## 6.1 CONCLUSIONS OF THE STUDY

In answering the questions set out in the initial aims of the study (section 2.3.10) the following has been established:

- the inclusion of a three week exercise programme in an abstinence rehabilitation programme does improve physical self-perceptions of physical self-worth, condition and strength. These physical self-perceptions are theoretically related to a hierarchical model of global self-esteem;
- the inclusion of a three week exercise programme in an abstinence rehabilitation programme does improve the physiological parameters of aerobic capacity and strength but not flexibility;
- participation in a three week programme followed by a twelve week home based programme does increase levels of physical activity in the short term, up to three months from time of entry to the programme, but not in the long term. Other strategies need to be considered that may increase adherence to exercise in the long term, this is discussed in the next section on further research;
- the inclusion of a three week exercise programme in an abstinence rehabilitation programme does not significantly lower levels of anxiety and depression;
- the effects of an exercise programme cannot be linked to maintaining abstinence levels.

In answering these questions all the aims of the study have been met. In addition, the following was also found as a result of the study. The use of self report to measure abstinence or controlled drinking is not accurate when measured against a laboratory

benchmark for chronic alcohol consumption. Improved physical fitness closely relates to self-perceptions related to self-worth, body strength and condition, indicating that it is likely that problem drinkers participating in exercise programmes will have increased self-efficacy in regard to exercise. There is an association between poor body image and the ability to maintain controlled drinking or abstinence, suggesting that realistic awareness of the negative effects of drinking and the positive benefits of stopping drinking are important in motivation to change behaviour.

The findings of this study suggest that the provision of a short three week programme of exercises followed by a home based programme can have a direct effect on improving the physical and psychological well being of problem drinkers. The impact of such a short period of intervention on aerobic fitness, physical activity levels and perceived self-worth may be of interest to physiotherapists and sports scientists. It is important to note that improvements in aerobic fitness were maintained up to five months from entry to the programme and that adherence to the home based exercise programme was evidenced up to three months from entry to the programme without any continued support, suggesting that support may further enhance adherence.

Finally, the results from this randomised controlled trial provides physiotherapists and others, with much needed evidence of clinical effectiveness from short term intervention comprising of six 30 minute exercise sessions and from a further twelve week home based exercise programme. This knowledge can be used to inform clinical guidelines for good practice for physiotherapists working with problem drinkers. The exercise programmes provided in this study are easy to replicate and are appropriate for use with people of different ages and fitness levels. For problem drinkers the beneficial effects of exercise as evidenced in this randomised controlled study will enable them to make an informed choice where exercise is offered within an alcohol rehabilitation programme.

## 6.2 FURTHER RESEARCH

There is still much to be learned about alcohol addiction and the role exercise can play to benefit health and mediate lifestyle change. The heterogeneity of this clinical population may however lend itself more to qualitative approaches of investigation to determine what it is that enables some problem drinkers to succeed in treatment where others fail. The findings of this study indicate that further research requires to address the following areas.

Exercise intervention studies with problem drinkers should include maximum tests of aerobic fitness, to confirm the baseline measures and changes over four weeks obtained from estimated tests in this study. Although the Astrand and Rodahl (1977) procedures for estimated  $VO_2$  max. have been found to be reliable and valid, the findings of this study are quite remarkable in relation to aerobic fitness benefits obtained in a short period of time. For this reason it is important to verify these findings with further laboratory tests with this patient population. Further research should consider the inclusion of laboratory based exercise fitness testing.

There is a need to consider how the benefits of exercise participation relating to self-perceptions and improved physical well being, evidenced in this study, can be integrated into modifying cognition related to dealing with high risk situations. This requires a more explicit link to be made between exercise participation and cognitive approaches to managing drinking behaviour, for example in teaching cognitive strategies such as self awareness, self image, self evaluation, stimulus control, and expectations. This approach requires to be evaluated in relation to maintaining abstinence or controlled drinking. Further work could include a study comparing exercise intervention, as undertaken in this study, with exercise intervention which includes a cognitive appraisal programme. The home based programme would also require to be adapted to include cognitive appraisal statements related to self image stimulus control and expectations. The impact of including cognitive strategies on adherence to exercise and maintenance of abstinence or controlled drinking should be evaluated.

Strategies for increasing adherence to exercise programmes need to be considered. A further study could compare short intervention followed by a home based programme as undertaken in this study against a home based programme where there is initial sessions on exercise counselling with an introduction to the home based programme followed by weekly telephone support and monthly meeting for review of fitness and goal setting. A further consideration could be providing people on the programme with the opportunity to exercise with others, through the use of a local buddy system.

There is also a need for research to evaluate adherence to exercise and its impact on short and long term abstinence where patients self select to participate in exercise within a treatment programme that offers a range of treatment options. Longitudinal cross cultural studies over a one year or longer time period are required to track patients particularly first time referrals to establish if there are common aspects of treatment intervention that are effective.

Within the profession of physiotherapy there is a need for continuing research to evaluate practice and to provide evidence of clinical effectiveness. It is hoped that this study, in addition to having the potential to inform current practice, will promote further research.

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## Appendix 1

**PATIENTS INFORMATION SHEET****The Investigation of Exercise as an Adjunct to the Treatment and Rehabilitation of the Problem Drinker**

**Why take part?** - it has been suggested that participation in an exercise programme is of benefit to people who are stopping drinking. The benefits are said to be not just in improving your fitness, but exercise may help you to feel good about yourself. It may be that exercise will help some people feel and cope better in remaining abstinent.

**What does the project involve?** - the project involves taking part in a 30-40 minute exercise session with a physiotherapist twice a week for the four weeks you are attending the unit. You will have a medical examination by the doctor in the unit, to make sure that you are well enough to participate in exercise. Your fitness will then be assessed and you will be asked to complete a few questionnaires asking about how you are feeling. The questionnaires will take about half an hour to complete. You will then be randomly allocated to one of two exercise groups A or B. This means that you do not get to choose which exercise group you are allocated into. Exercise group A consists of moderate intensity exercises. Exercise group B consists of light intensity stretching exercises. You should not experience any physical discomfort during or following exercise, as the exercises will be at an appropriate level for your fitness.

Once you are discharged from the unit you will be given a booklet with some information to enable you to continue to exercise safely at home, if you wish to do so. You will be asked to return to the unit to have a further fitness test and to complete another set of questionnaires at 4 weeks and 4 months after discharge. On these return visits you will be required to have a small blood sample taken from your arm, to look at changes related to alcohol over time. You will receive a payment of £10 for each of these return visits, this is to cover your expenses.

**What if there are problems after the project begins?** - once you have begun the project we hope that you will be able to complete it, however if there are any problems that we can not sort out, you are free to drop out at anytime, and your care will in no way be affected.

**What if I do not wish to participate in the project?** - if you do not wish to participate in this trial your care will in no way be affected. You can still join in the exercise classes, although fitness measures will not be taken.

Your participation in the study may not benefit you directly but the findings of this study could help in the development of treatment and benefit patients in the future. thank you very much for your help - please do not hesitate to ask if you have any other questions.

Marie Donaghy  
Researcher and Lecturer Department of Physiotherapy, Queen Margaret College,  
Edinburgh.

Appendix 2

**INFORMED CONSENT FORM**

**The Investigation of Exercise as an Adjunct to the Treatment and Rehabilitation of the Problem Drinker**

Consent form - Exercise project for problem drinkers

You are invited to take part in the above named study. The details are clearly stated in the attached patient information sheet. If you agree to take part please sign the form below.

Patient's Name.....

I have read this consent form and the attached information sheet and / or discussed the project with the physiotherapist, and understand that any information I give will be strictly confidential. I am willing to give my consent to take part. I understand that I may drop out of the project at a later time without this affecting my treatment.

Signature.....

Date.....

Witness Signature.....

Date.....

Research Project M. Donaghy 1994/5.

## Appendix 3

**7 DAY DRINKS DIARY.**

PLEASE TICK ONE OF THE FOLLOWING:

IS YOUR GOAL TO ACHIEVE-

**ABSTINANCE**

**CONTROLLED DRINKING**

Please indicate below your drinking behaviour in the last 7 DAYS

Day	Units of alcohol	Location	Who with
Sunday			
Saturday			
Friday			
Thursday			
Wednesday			
Tuesday			
Monday			

## Appendix 4

**The Investigation of Exercise as an Adjunct to the Treatment and Rehabilitation of the Problem Drinker**Procedures for Gartnavel Royal Hospital

All patients male and female who are under the age of 60 and who do not suffer from any of the following medical conditions:

- advanced osteoarthritis;
- severe chronic obstructive airways disease;
- recent myocardial infarct (in past 6 weeks)

are invited by the key worker to participate in the study if their addiction problem is predominantly one relating to alcohol. The key worker is responsible for explaining what the study is about and will give the patient the information sheet. This will normally be done on the Wednesday following admission. Patients are given 24 hours to consider whether they wish to participate or not. When patients agree to join the study the key worker will ask the patient to sign the consent form, this requires to be countersigned by the key worker. The alcohol clinic programme manager (Susan) will compile a list of names of those joining the study.

Marie Donaghy (researcher) will phone on Thursday morning to establish if there are any new patients joining the study. Fitness testing and administration of questionnaires will normally be undertaken on the Thursday afternoon.

In addition to the medical conditions listed above patients who are found on medical examination to be unfit to participate are excluded from the study.

Fitness testing

Marie Donaghy will meet patients to be tested at the alcohol problem clinic at Gartnavel and take them to the physiotherapy department for testing. They will also complete questionnaires on mood, self perception profile, and previous exercise levels. The data will be filed on a portable computer on site. Confidentiality is assured.

Randomisation to groups

On completion of the above tests the patients will be randomly allocated by the physiotherapist Nan Cameron (using the lists provided) to either exercise group A (aerobic) or exercise group B (conditioning and stretching). The random list has been compiled by the researcher who remains blind to the group allocation. Nan colour codes the patients treatment card and gives the patient the times of the twice weekly classes. Patients are advised by the physiotherapist on their once a week self assigned exercise sessions.

Attendance at classes

Patients are required to attend classes twice weekly for three weeks. The time and place for these classes will be arranged by Nan in consultation with Susan.

### Non-attendance

The physiotherapist (Nan ) will record attendance at classes and will record patients report of the self assigned exercise session, the date it was undertaken and length of time in activity. The physiotherapist will maintain patient records in the usual manner. Non-attendance at classes will be recorded.

If a patient drops out of the unit / programme after more than two weeks attendance at classes they should not be included in the study if they are re-admitted within 6 weeks of dropping out.

Patients who are re-included in the study after 6 weeks absence are considered to be new patients and require to be fitness tested etc. Patients will only be re-included to the study once.

### Attending classes

Patients who are allocated to exercise group A will be required to wear loose clothing suitable for exercise (T shirt or sweat shirt; shorts or track suit bottoms) and suitable footwear (trainers, gym shoes). Patients attending group B should wear comfortable clothing (slacks, jeans, sweater). The physiotherapist will be pleased to advise patients on this.

### Exercise sessions

Nan Cameron will take the twice weekly exercise classes. Taped music with instructions are used for both group A and group B the sessions will last for 30 minutes. At the end of the first session patients in group A and B will be given a handout. Group A's handout includes instructions on warm up exercises and a walking programme. This is an extract from the first section of the home based exercise programme and should be used as a guide to the self assigned exercise session. Group B will be given an instruction sheet of stretching exercises, both groups are advised to use these instructions to take one further 30 minute session unsupervised each week.

### Maintaining communication

The research secretary (Linda) will phone Nan Cameron once a week on the weeks between testing and re-testing. Any problems should be notified as they arise to the researcher or her secretary.

### Re-testing at four weeks

Marie Donaghy will arrange with patients and key worker the date and time for re-testing. Normally this will be the Thursday prior to discharge. Patients will be collected from the alcohol problems clinic by the researcher and taken to the physiotherapy department for fitness testing and administration of questionnaires.

### Home exercise programme

Patients are given information on how to continue to exercise at home. Group A will receive a 12 week home based exercise programme. This is a programme of graded exercises, compiled by the research team at Glasgow university, and specifically chosen for this population to enable them to continue to progress at home. Group B will receive a book on exercise published by HEBS. This offers general advice on starting to exercise. Both groups will be encouraged by the researcher at re-testing to continue with their home based exercise programme.

### One month follow-up

Patients will be notified in writing by the researcher's secretary (Linda) of date to attend for follow-up visit. The key worker and charge nurse at the alcohol problem clinic will also be notified. The patient will have a blood sample taken by the Senior House Officer, who will also have been notified and given agreement to be present at this recall appointment. The blood sample will then be taken to the local laboratory by the researcher following procedures laid down for collection and handling of blood samples. The patient will be collected from the alcohol problem clinic by the researcher (Marie) and taken to the physiotherapy department for fitness testing and administration of questionnaires. The patient will receive a payment of £10 from the researcher for attending for recall. The patient will sign a receipt this will be witnessed by a member of staff.

### Four month follow-up

The procedures will be the same as those at the one month follow-up. At monthly intervals between the recall sessions patients will be sent a letter and a 7 day physical activity form to complete and return in a reply paid envelope.

Marie Donaghy can be contacted at Queen Margaret College on 0131 317 3647 or Linda Bruce secretary on 0131 317 3000.

## Appendix 5

**Study: The Investigation of Exercise as an Adjunct to the Treatment and Rehabilitation of the Problem Drinker.****Blood Sampling Procedures.****Hospitals Concerned**

Gartnavel Royal Hospital  
Edinburgh Royal Infirmary  
Crichton Royal Dumfries  
Ailsa Hospital Ayrshire

**Blood Sampling Procedures.**

1. *Sample specification:*

Serum Only - No Haemolysis
2. *Specimen Collection and Processing:*
  - (a) Using a PLAIN 7 ml Vacutainer or Monovet, with appropriate needle, blood is allowed to flow from an antecubital vein until the capacity of the tube is reached. Identify and date the tube to match the biochemistry request form.
  - (b) Allow the blood to clot and centrifuge for 10 minutes at 2000g. Remove an aliquot of serum (1ml is adequate) and place in transport vial. Ensure the serum sample has the patient's identification on the vial.
  - (c) Post immediately by first class mail to:

The Biochemistry Department  
Royal Infirmary  
Glasgow G4 OSF

Whenever possible, do not post on a Friday or the day before a (Glasgow) public holiday.

**IT IS ESSENTIAL THAT NEXT-DAY DELIVERY IN GLASGOW IS ACHIEVED.**

## Appendix 6

### **INDEPENDENT EXERCISE SESSION INSTRUCTIONS FOR GROUP A**

The following exercises can be undertaken as part of your independent exercise session. The illustrations include exercises that are designed to prepare your body for exercise. In addition guidance is given on how to pace walking if you wish to undertake this activity as your independent exercise session. There are also some exercises illustrated and explained for flexibility and muscular endurance. Other options that may be available for participation as your independent exercise session include the following: using gymnasium facilities, playing badminton or football. The physiotherapist will be pleased to advise you of a suitable form of exercise taking into account your level of fitness and your preference for exercise activities. Whatever activity you choose to do you should follow the exercises in section 1 WARM UP EXERCISES and FLEXIBILITY exercises to prepare your body for further activity. Your independent exercise session should last for a minimum of 30 minutes.

When you complete your independent exercise session **YOU WILL HAVE ACHIEVED** your physiotherapy exercise goal for the week. I hope you enjoy your exercise session. Please remember to do this once every week in addition to attending the twice weekly sessions at the physiotherapy department.

Marie Donaghy  
Research project 1994/5.



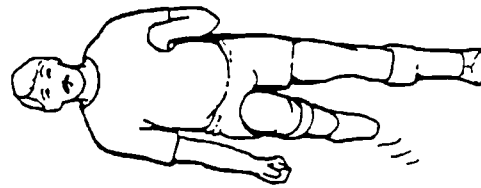
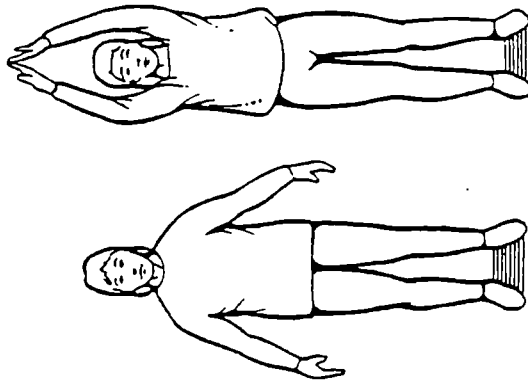
# Section 1 WARM UP EXERCISES

The following section is designed to prepare your body for exercise. The aim is to gradually increase the body temperature and heart rate and get the body moving gently.

## Side arm raise

*(Repeat 4 to 8 times)*

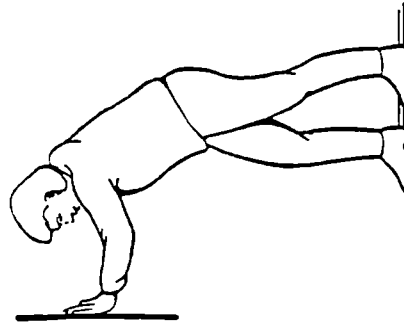
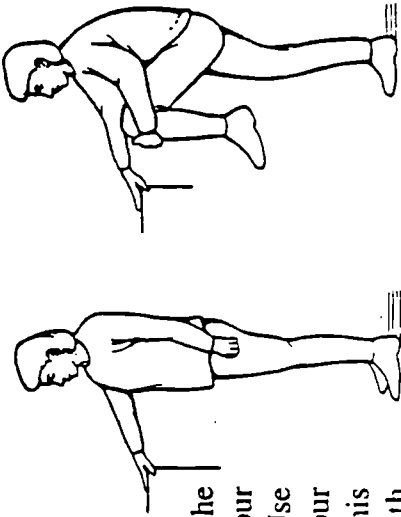
Stand with your arms at your side. Slowly raise both arms out to the sides and up over the head. Gently lower the arms back to the starting position.



## Knee to chest

*(Repeat 4 to 8 times)*

Stand facing a table or sturdy chair. Place your right hand on the table/chair for support. Raise your left knee up towards your chest. Use your left hand to gently pull your knee in towards your chest. Do this 4 to 8 times then repeat with other leg.



## Calf stretch

*(Hold for 20 seconds)*

Stand facing a wall. One foot should be closer to the wall than the other, place both hands on the wall. Bend the elbows to lower your upper body towards the wall. Bend the knee closest to the wall. Keep your back leg straight and push the heel of the back foot down into the floor. Both feet should be facing the wall. You should feel a stretch in the calf muscle of the back leg.

## Marching on the spot

Stand with your legs shoulder width apart. Gently start marching on the spot. Gradually lift your knees a little higher and swing your arms up and down in opposition to your legs. Keep doing this for 1 minute.

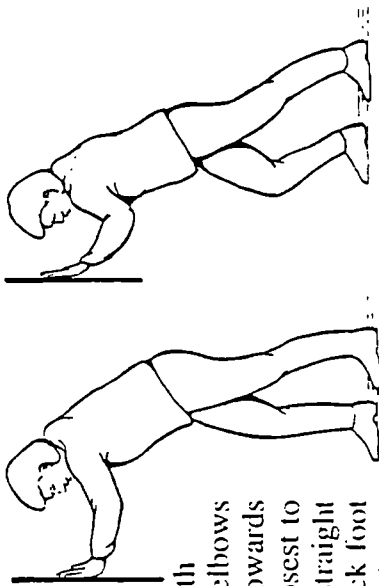
# FLEXIBILITY

These exercises should be performed in a controlled manner without bouncing. Hold the stretched position described for 20 seconds.

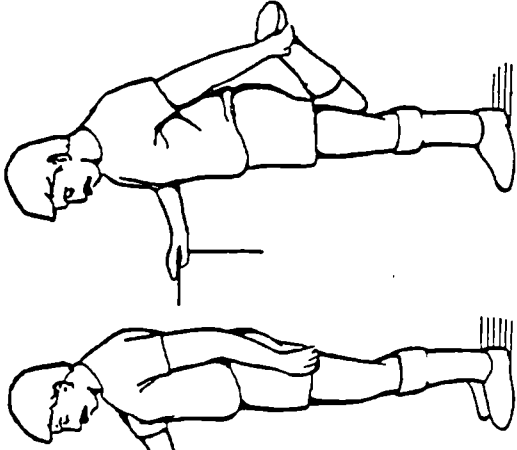
## Calf stretch

*(Hold for 20 seconds)*

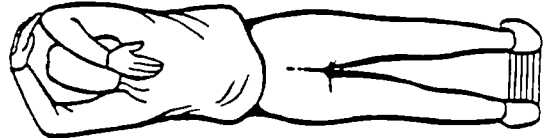
Stand facing a wall. One foot should be closer to the wall than the other, place both hands on the wall. Bend the elbows to lower your upper body towards the wall. Bend the knee closest to the wall. Keep your back leg straight and push the heel of the back foot down into the floor. Both feet should be facing the wall. You should feel a stretch in the calf muscle of the back leg.



**Thigh stretch** Stand near a wall (use the wall for support). Bend one knee bringing the foot backwards towards your bottom. If you can, gently hold onto your foot with your hand and bring the foot closer to your seat. If you find this difficult then try simply to catch hold of your trouser leg. Or if you find it easier you could lie on your side. Pull your left foot towards your bottom with your left hand and then swap sides.

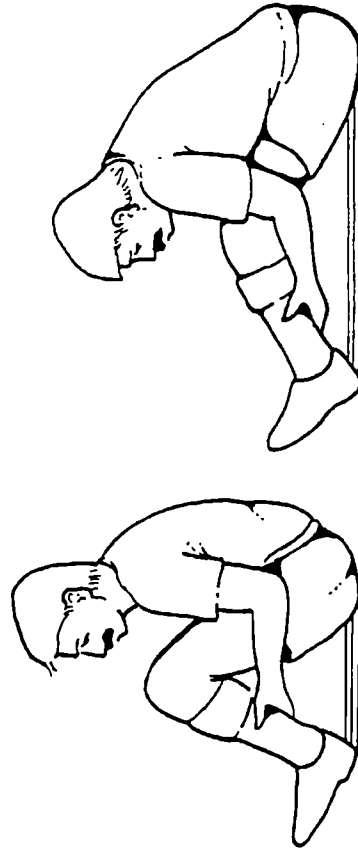


**Triceps stretch** In either a seated or standing position raise your right arm overhead and then drop the right hand back behind your head. If you can, reach up with your left hand and gently pull your right elbow towards your head. You should feel a stretch in the back of your right upper arm, the shoulder joint and perhaps down the right side of your chest. Repeat for the other side.

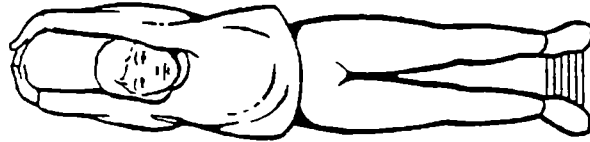


## Sit and reach

Sit on the floor with your knees slightly bent. Gently lean forward over your knees. Gently straighten your legs until you feel a stretch in your hips, lower back or the backs of your legs.



**Total body stretch** Stand and bring both arms overhead. Stretch yourself as tall as possible.



## AEROBIC EXERCISE

### **15 minutes of walking** (after you have warmed-up)

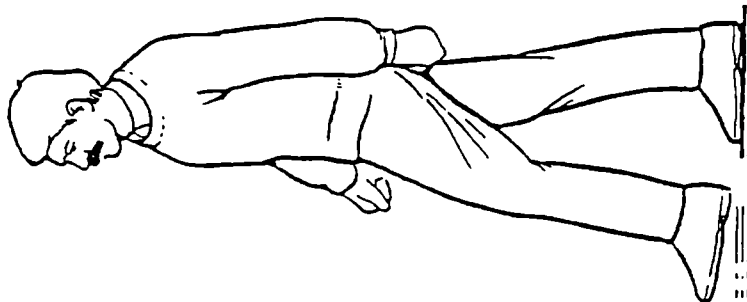
If you are unaccustomed to walking then your task is to build up gradually over the three weeks until you can walk continuously for 15 minutes. If you walk regularly then you should manage to keep going for this length of time without stopping.

### **Pace**

You should walk at a pace which you find comfortable. It should be a brisk walk but not so fast that you need to stop or that you feel breathless. We will give you more detailed advice about the intensity and pace of your walk in the subsequent sections.

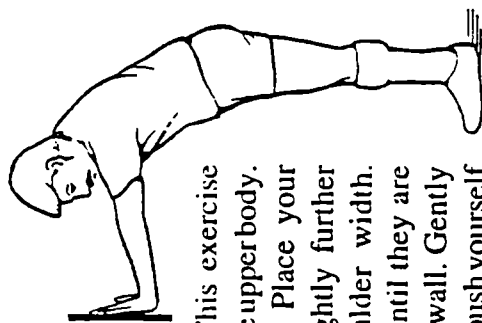
### **Distance and route**

Try to choose a route which is safe, interesting and reasonably flat. It might be nice to walk in one of the city's parks or an area of the city that you particularly like. The distance is not especially important. You will find over the twelve weeks, as you get fitter, that you will gradually be able to walk further in the required time (in this instance 15 minutes).



# LOCAL MUSCULAR ENDURANCE EXERCISES

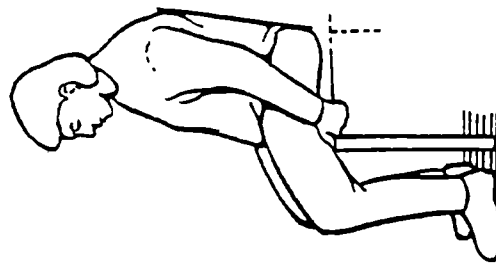
These exercises should be performed after your walk. Complete as many as you comfortably can in 30 seconds. If you feel your muscles very tired before the 30 seconds are up then take a rest and perform the exercise more slowly the next time. Try to work your muscles through as full a range of movement as is comfortable. These exercises should not be painful. Try to keep to a regular breathing pattern when doing these exercises and avoid holding your breath.



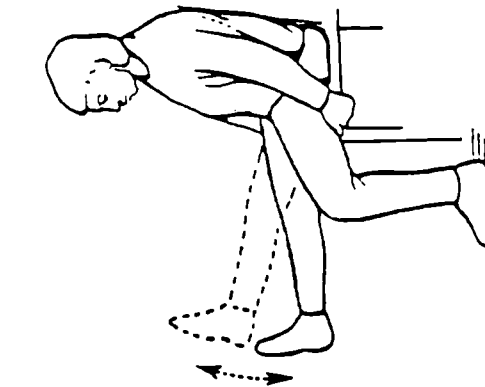
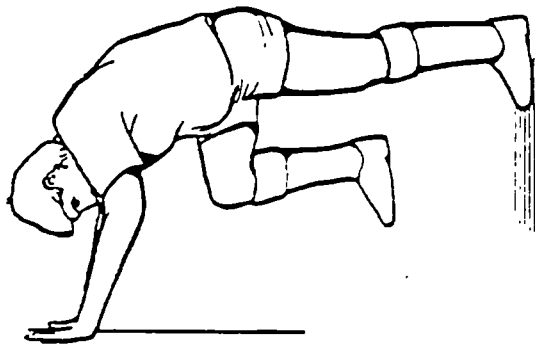
**Wall push ups** This exercise works the muscles of the upper body. Stand facing a wall. Place your hands on the wall slightly further apart than your shoulder width. Move your feet back until they are about two feet from the wall. Gently straighten your arms to push yourself away from the wall then slowly lower your shoulders back towards the wall.

**Knee lifts** Stand facing a wall about 2 feet from the wall and place your hands against the wall at shoulder height for support. Balancing on one foot, pull your other knee up towards your chest and at the same time lean forward so that you lower your chest towards your knee. Repeat this alternately with your right and left knee. You

should feel the muscles in the lower abdomen working while you perform this exercise. Complete as many as is comfortable in 30 seconds.



**Single leg lifts** This exercise works the leg (thigh) muscles. Sit in a chair with your back firmly against the back of the chair. Straighten one leg then lift it until the thigh comes off the chair. Lower the leg until the thigh touches the chair. Repeat. Perform this exercise for 20 seconds with one leg then 20 seconds with the other. You may lower your foot to the ground at any time - just try to decrease the number of times you lower your foot with each subsequent work-out.



## Appendix 7

**INDEPENDENT EXERCISE SESSION INSTRUCTIONS FOR GROUP B****Stretching and Conditioning Exercises**

You may be able to borrow a copy of the tape from the physiotherapist to undertake your additional exercise session. If this is not possible, please read over these exercise instructions before carrying out the exercises.

Position: Lie on top of your bed or on a mat on the floor, have your head supported by a pillow.

Imagine there is a line going down the middle of your body and a line going across your body. You are now going to stretch each of these four quadrants of the body. After stretching each section of the body you are instructed to do some slow deep breathing.

1. Start by stretching down through the right limb. Gently push down from the hip straightening the knees. Push away with the right heel, and pull your toes gently towards you. Do this exercise very slowly and feel the tension in the muscles as you are pushing down through the right leg, then slowly and gently let go and allow the muscles to return to their starting position.

Focus on how the muscles feel once you have let them go. Rest for about 30 seconds then repeat this stretch twice more. After your third stretch do some slow deep breathing. Feel the lungs gently fill with air as you breathe in and out, repeat this three or four times.

2. Stretch down through the left lower limb. Gently push down from the hip straightening the knees. Push away with the left heel, and pull your toes gently towards you. Do this exercise very slowly and feel the tension in the muscles as you are pushing down through the left leg, then slowly and gently let go and allow the muscles to return to their starting position.

Focus in once again to the sensation in the muscles in the left leg once you have let them go. Rest for about 30 seconds then repeat this stretch twice more. After your third stretch do some slow deep breathing. Focus on the movement of the chest as you slowly and gently breathe in and out, repeat this three or four times.

3. Take the right arm above your head and let it rest in a comfortable position above your head. Then slowly and gently stretch upwards, pushing slowly up through the shoulder, followed by straightening the elbow and slowly and gently pushing upwards through the wrist straightening and lengthening the fingers. Enjoy the sensation of this full slow upper limb stretch, then slowly and gently let go and allow the arm to return to its starting position. Focus in on the sensation in the muscles as you stop stretching the arm. Rest for about 30 seconds then repeat this sequence

twice more, resting in between each stretch. Then bring the arm back down by your side to rest in a comfortable position.

After your third stretch do some slow deep breathing. Feel the lungs gently fill with air as you breathe in. Focus on the movement of the chest as you slowly and gently breathe in and out, repeat this three or four times.

4. Take the left arm above your head and let it rest in a comfortable position above your head. Then slowly and gently stretch upwards, pushing slowly up through the shoulder, followed by straightening the elbow and slowly and gently pushing upwards through the wrist straightening and lengthening the fingers. Enjoy the sensation of this full slow upper limb stretch, then slowly and gently let go and allow the arm to return to its starting position. Focus in on the sensation in the muscles as you stop stretching the arm. Rest for about 30 seconds then repeat this sequence twice more, resting in between each stretch. Then bring the left arm back down by your side to rest in a comfortable position.

After your third stretch do some slow deep breathing. Feel the lungs gently fill with air as you breathe in. Focus on the movement of the chest as you slowly and gently breathe in and out, repeat this three or four times.

Take a little time to think about the different sensations in your body and muscles after completing this four quadrant stretching. Try and let the muscles of your back and neck relax into the mat or bed. If you feel these muscles are tense, gently push back into the bed, mat or pillow gently stretching these muscles and then slowly let go again.

To finish your exercise session take both arms slowly above your head and gently push upwards with both arms and at the same time gently push down with both lower limbs. **THIS MUST BE DONE WITH CARE VERY SLOWLY AND GENTLY DO NOT USE FORCE DURING THE STRETCH.**

Finish once again with some slow easy deep breathing exercises.

Well done, you have taken the time to undertake this additional exercise session and in so doing **YOU HAVE ACHIEVED** your physiotherapy exercise goal for the week.

You should complete these exercises in 30 minutes.

I hope you have enjoyed your exercise session. Please remember to do this once every week in addition to attending the twice weekly sessions at the physiotherapy department.

Marie Donaghy  
Research project 1994/95.