EFFECTS OF FLOTATION REST AND PROGRESSIVE MUSCLE RELAXATION ON BLOOD PRESSURE, HEART-RATE, ANXIETY, AND MOOD OF CYCLISTS

Peter Stanislawski.

Thesis submitted in partial fulfilment of the requirements for the Honours Degree in Psychology.

University of Adelaide.

Word Count 14990.

September, 1993.

ACKNOWLEDGEMENTS

I would firstly like to thank my supervisors, Dr Peter Delin and Cathy Martin for their assistance and guidance throughout the year.

I would also like to thank Ian McKenzie, Richard Meadows, Bob Wilson, and Graham Winter for their assistance.

Thanks to the management and staff at the South Australian Institute of Sport for making their facilities available, and their assiatance throughout the study.

To all the the cyclists who participated in the study - thank you for your supreme effort. Your contribution deserves the utmost recognition.

Statement

This thesis does not contain material which has been previously offered for any other degree or diploma at any other university, nor to the best of my knowledge, does it contain previously published material, except where due reference is made in the text.

Peter Stanislawski

September, 1993.

Table of Contents

Abstract

The effects of relaxation on athletic performance, reducing an athletes' susceptibility to injury, and overcoming the effects of over-training were considered. 15 competitive cyclists were randomly assigned to either a Flotation Rest condition, or a Progressive Muscle Relaxation condition. Pre-test and post-test measures of blood-pressure and heart-rate were obtained over six treatment sessions. Pre-experimental and post-experimental measures of mood and anxiety were obtained using the POMS (McNair et al, 1971) and the SCAT (1977) respectively. Significant reductions were obtained on the post-test measures of blood-pressure and heart-rate for both conditions. Diastolic blood-pressure was significantly lower across all sessions on the post-test measures than on the pre-test measures for the Flotation Rest condition. This reduction was significantly lower for the Flotation Rest condition than the Progressive Muscle Relaxation condition. Both treatment conditions resulted in lower post-test systolic blood-pressure measures. Heart-rate was significantly lower on post-test measures following either treatment. No changes were detected in the POMS total mood scores on the sub-scale scores. Significant reductions were obtained in anxiety for the Progressive Muscle Relaxation condition. It was concluded that repeated exposure to Flotation Rest increases the reductions in blood-pressure on each subsequent session.

Introduction

Sports psychologists need to be able to offer a range of services that will meet the specific needs of the athlete. These services may range from assistance in skill improvement to reducing pre-game arousal levels Reducing athletes' arousal levels has been claimed to increase performance and also lower susceptibility to injury. The method most commonly used is some form of relaxation treatment. Relaxation treatments may be useful as a means of preventing the onset of staleness; the state whereby the athlete has been overtrained to the point of exhaustion. It is the aim of this review to consider the performance-arousal relationship, the anxiety-injury relationship, and the relaxation methods used to control arousal and anxiety. This review also looks at the effects of overtraining on mood, and examines the possibility of using certain forms of relaxation to overcome these effects.

Performance Arousal Relationship

The concept of arousal has received considerable attention within many of the fields of psychology. For the sports psychologist, arousal is usually viewed as an energising function that directs the body towards selected activities. An individuals arousal state is considered to vary on a continuum, ranging from deep sleep to extreme excitement (Malmo, 1959). Generally it has been assumed that once a state of high arousal develops performance is impaired (Oxendine, 1970). Two prominent theories, the drive theory (Hull, 1943; Spence, 1951), and the inverted-U hypothesis (Yerkes & Dodson, 1908) attempt to explain the arousal performance relationship. For the purposes of drive theory, the term drive is equated with arousal. According to drive theory, as modified by Spence and Spence (1966) performance is a multiplicative function of "habit" and "drive" where 'habit' refers to the sequential order of the dominant responses. During skill acquisition, initially the dominant responses are likely to be incorrect. In such a situation increases in arousal impair performance. As the number of trials increases, the dominant response, in turn, becomes the correct response. An increase in arousal facilitates performance, in such a manner that as arousal increases, so too does performance. This relationship continues to the point where the maximum possible levels of arousal correspond with the highest possible performance levels. The extent to which this linear relationship actually occurs is questionable. Apart from the anecdotal evidence according to which "superhuman" feats are accomplished under states of extreme arousal, there seems to be scant evidence in support of drive theory, with the majority of studies that tested its predictions failing to support the theory (Martens, 1971). Furthermore, drive theory appears to be extremely difficult to test in the area of motor performance, as the limited task parameters to which the theory appears appropriate negate its effectiveness (Landers, 1980). In order to test the theory, arousal levels would need to be maximised. Not only would this be difficult to accomplish, but it is also unethical. Some anecdotal evidence seems to suggest that the theory is not applicable in the area of motor performance. Many athletes, actors, and musicians claim that their performances are hampered by excessive arousal.

Due to the above-mentioned reasons the inverted-U hypothesis has emerged as the preferred theory of the arousal performance relationship (Klavora, 1979; Landers, 1980; Oxendine, 1970). According to the inverted-U hypothesis there is a progressive increase in performance efficiency as arousal increases. However, once arousal continues to increase beyond a certain point, performance decrements occur. Graphically represented, the performance-arousal relationship appears curvilinear.

Individual Differences.

Individuals may vary in their ability to perform specific tasks. One of the strongest individual factors that may effect optimal performance levels is "personality". Some athletes seem to be able to perform at their best when the pressure is on. These athletes are commonly referred to as "clutch" players, while other athletes seem to buckle in similar pressure situations. These athletes are referred to as "chokers". Given these common observations, trait anxiety is considered to be one of the most relevant personality variables to influence performance. To assess competitive trait anxiety Martens (1977), developed the Sport Competition Anxiety Test (SCAT). It measures the tendency to perceive competitive situations as threatening (A-trait), and to respond to these situations with feelings of apprehension or tension (A-state). Marten's theoretical model presents competitive A-trait as the mediator between the competitive stimulus and the A-state response.

Despite the anecdotal evidence that individual differences figure in the performance arousal relationships, most studies tend to focus on between-subject or inter-individual comparisons that fail to control for differences in skill level as well as being insensitive to an individuals' customary level of anxiety (Weinberg, 1990). Consequently, where studies fail to produce the inverted-U curve, it may be due to the omission of individual difference factors. Sonstroem and Bernado (1982), performed a study testing the inverted-U hypothesis which controlled for inter-person variation in anxiety responsiveness. The experimental design incorporated repeated state anxiety measurements on the same people, and provided an analysis of within-subject variance devoid of interpersonal differences in levels of anxiety-responsiveness. The emphasis on intra-subject variance stemmed from the suggestions of Schnore (1959), who concluded that people showed such different arousal responses that research concerning the autonomic system should use designs which control for the between-subjects differences, rather than independent groups designs. Sonstroem and Bernardo obtained two measures of basketball performance: game statistics composite and total points. Subjects were divided into A-trait groups following completion of the Sport Competition Anxiety Test (SCAT) (Martens 1977) prior to a pre-season practice match. A-state measures were obtained 20-30 minutes before each game of the tournament, again through the administration of the SCAT. It was hypothesised that an individual median level of state anxiety across the three games would be associated with the best performance of the individual for the three games. The pattern of their results resembled the inverted-U curve. The highest dependent variable values were associated with "moderate" levels of trait and state anxiety, and the lowest dependent variable values were associated with the "high" category of both trait and state anxiety.

Stress and Anxiety Effects on Performance

Anxiety and stress have been considered to be separate concepts. As such they may be expected to affect performance on a motor task differently. Martens and Landers (1970), exposed their subjects, who were either, low, medium, or high in trait anxiety, to one of three levels of psychological stress. The stress and anxiety factors formed the predicted inverted-U shaped curve. However, the two factors did not interact to affect motor performance.

The extent to which anxiety and stress affect physical performance in both the laboratory and field setting was investigated by Kleine, Sampedro, and Melo (1988) Runners were subjected to either neutral or stress inducing instructions, and measured on the physiological performance parameters of VO^2max (maximum oxygen uptake in litres per minute), physical work capacity (expressed as watts) and state anxiety. Self-reported state anxiety showed a significant increase for the stress-induced subjects. The most informative measure of stress impact was the heart-rate curves. All athletes displayed a marked increase in heart-rate at all levels of work load. The effect of trait and state anxiety on performance was assessed in practice and competition settings. Self-reported state anxiety was significantly higher in the competitive condition. In addition, running times were significantly slower in the competitive situation. The impact of state anxiety on running performance indicated an inverted-U relationship. However, this was observed only for the low trait-anxious group, as their best performances occurred under conditions of medium arousal. The results of this study indicate that heart rate is a powerful indicator of stress, as all subjects exposed to stress showed significantly higher heart-rates.

Despite the considerable criticism associated with the performance-arousal relationship within the research arena (Kleine, 1990., Naatanem, 1973., Neiss, 1988), coaches consider arousal to be an important factor mediating performance in the field setting. The Australian Cycling Federation Coaching Manual Level 2 describes various factors analogous to those described above which are considered to affect performance. Factors include individual difference variates such as motivation and experience, and also task characteristics, such as type of competitive situation and level of competition.

As there is a considerable number of studies that support the inverted-U hypothesis, and given the general acceptance amongst coaches of the performance arousal relationship, it seems that even in the light of the extensive criticism the theory is subjected to, sport psychologists cannot afford to dismiss the notion. Furthermore, a survey conducted by Suinn (1985) found that some of the services most frequently requested by athletes in the 1984 Olympics were relaxation, self-regulation, concentration, and visualisation–presumably to enhance performance. In light of these generalisations, it would seem that some method of controlling arousal is needed whereby the athlete achieves a state of relaxed alertness.

Susceptibility to Injury

The extent to which stress is a mediator in an athlete's susceptibility to injury has recently been given considerable attention. The precise manner in which stress might increase vulnerability to injury is not clear. Nevertheless, two mechanisms have been put forward. The first involves attentional disruption that develops as the athlete becomes overly concerned with stressful events and their possible negative outcomes. Devoting attention to irrelevant cues could distract the athlete from environmental cues that signal danger. As a consequence, the risk of injury would be increased (Anderson & Williams, 1988; Bramwell, Masuda, Wagner, & Holmes, 1975). A mechanism such as this could be considered to fall in line with Easterbrooks' (1959) cue utilisation theory, which suggests that over-arousal directs attention away from relevant cues. In the same vein, Nideffer (1981) proposes that the interactions of anxiety, performance demands and attentional abilities contribute to the probability of injury. Furthermore, optimal performance necessitates the ability to redirect attention to relevant cues as a function of the variation in relevance. Jacobs (1988) claimed that cyclists needed to be effective at the four attentional skills proposed by Nideffer (1976), which are broad internal/external focusing, and narrow internal/external focusing. Also they needed to be extremely effective in being able to narrow their focus of attention when required. Injuries in competitive cycling are predominantly the result of collisions with other cyclists (Bohlmann, 1981). As competitive road and track racing necessitates riding in very tight-knit bunches, being aware of the proximity of other riders is important. In this respect, other competitors could be considered to be relevant cues for the prevention of injury

The other mechanism suggested is that stress creates physiological arousal that increases muscle tension, which results in a reduction of motor co-ordination and motion fluidity. Consequently the risk of injury is increased. Evidence which tends to support this view comes from the kinetic movement study of Beuter and Duda (1985), who found that high levels of arousal were associated with changes in the movement kinetics of distal joints, to the extent that what was once a smooth, seemingly automatic, movement become affected by volitional control.

The relationship between stress and college football injuries was investigated by Cryan and Alles (1983). Players from three institutions completed a life-events questionnaire; (The Social and Athletic Questionnaire), which consisted of 48 life events likely to be experienced by a college football player. Their trainers completed, on a weekly basis, an injury abstract form which was analysed by The National Injury

Reporting System. The results indicated that an accumulation of stress over a given period increases the likelihood of illness for an individual.

The relationship between psychological stress, performance, and injury in sport was reviewed by Hardy (1992). It was concluded that although the stress-injury relationship in sports is not supported by great quantities of empirical evidence, that which is available suggests that many of the same psychological skills that are credited with enhancing performance are suitable as a means of reducing an athlete's susceptibility to injury. Psychological skills that were recommended include goal setting, imagery, self-talk, and relaxation skills.

Psychological and Physiological Indicators of Overtraining and Staleness.

Overtraining occurs when an athlete is subjected to chronic physical overstrain. To a certain extent this is a necessary aspect of the training plan, as it contributes directly to performance increases. The body gradually adjusts to increasing demands, and becomes stronger. However, if the demands are too great, or are undertaken too frequently, the body cannot adapt, the athlete becomes exhausted, and performance decreases (Matheny, 1986). Detecting the onset of overtraining has usually depended on the subjective evaluations of coaches and athletes, which were often based on performance outcomes. Ideally, indicators other than performance are desirable in order to assess the effects of a training stimulus, and/or provide appropriate counter-measures to prevent the athlete from entering into a state of exhaustion.

Recent research has provided physiological and psychological indicators of overtraining. Over a ten-year study Morgan, Facsm, Brown, Raglin, O'Connor, and Ellickson (1987) monitored the mood states of 400 male and female competitive swimmers at intervals of 2-4 weeks during seasons, at the onset of the season, after the peak micro-cycle in mid season, and again at the end of the season. The Profile of Mood

States (POMS) (McNair, Lorr, and Droppleman, 1971) was used as measure of mood. Training load was measured in yards swum per day as part of their training program. Distance varied from an average of 3000 yards per day at the onset of the season, to 11,000 during periods of increased work load, while during tapering distance was reduced to 5000 yards per day. Their results indicate that the greatest amount of total mood disturbance occurred following the most intense micro-cycle, in which the average distance covered in training was between 10,000 to 15,000 yards per day. Evaluation of the individual POMS variables for 15 female swimmers revealed a significant increase in Depression and Anger, while Vigour decreased, but not significantly. For 16 male swimmers, the significant changes in global mood were due to a significant increase in Fatigue, and a significant decrease in Vigour. Furthermore, there was a corresponding increase in mood disturbance associated with a progressive increase in training load.

In order to evaluate whether the psychological effects observed with the swimmers could be generalised to other sports a group of wrestlers undergoing an intense training program were studied by Morgan et al (1987). The results parallel those of the swimmers, with mood disturbances reaching their highest level during their most intense micro-cycle, with the tapering of training load resulting in improved mood states. Of particular interest were the strategies used by the wrestlers to overcome staleness. Three wrestlers elected to rest for periods ranging from 1 to 2 weeks. Complete rest was associated with improvements in mood states. It was suggested that rest was an effective recuperative strategy.

The utility of the POMS (McNair, 1971) as an indicator of overtraining was validated in a study of the effects of overtraining in highly-trained distance runners (Verde, Thomas, and Shepard, 1992). Ten distance runners, all of whom were of world standard, were subjected to an average increase in training-time of 38% over their normal training routine for a period of 3 weeks. All subjects made 5 visits to the laboratory where they were assessed on an extensive range of physiological measures, which included; maximal oxygen uptake, blood sampling for hormonal changes, heart-rate, and the POMS. Visits 1 and 2 followed a 3-week period of adherence to their normal training plan. Thereafter training intensity was increased for the 3-week experimental period, with the 3rd and 4th visits occurring during this period. The 5th visit occurred after 3 weeks of reversion to their normal training program. Running performance did not improve during the period of intensive training, and 6 subjects developed sustained fatigue, indicating that training was excessive. Of all the measures obtained the POMS was the best single marker of disturbed function, with increases in Fatigue and decreases in Vigour observed. Resting heart-rate did not provide a useful measure of overtraining in this study. Even though there was an increase in morning resting heart rates, this increase was not significant.

The effects of tapering (ie; intensive training followed by reduced training) were studied using a group of elite pursuit and sprint track cyclists by Pyke, Graig, and Norton (1988). The aim of tapering is to improve performance by optimising the physiological, biomechanical, and psychological responses of the athlete. The physiological and psychological responses of 6 cyclists were compared during exposure to intense and to tapered training loads. Training-loads for the pre-taper period of 5 days consisted of 430 km of road work, two 1-hour intensive interval sessions, a 1-hour continuous ergometer session, 2 weight training sessions, and 1 competitive racing session. Interval training refers to intensive training where the athlete is subjected to an intense workload for a pre-determined period, after which the athlete reduces the workload only long enough to achieve a certain level of recovery, after which the intensity is once again increased (Matheny, 1986). The equivalent 5 day tapering period involved a 20% reduction in the road distance covered, and the removal of the interval sessions. The remainder of the program was not altered to that of the pre-taper period. Because of the small number of subjects and the limited number of observations the data was presented as a series of case studies. The cyclists who profited most from the tapering period in terms of total work output, maximal oxygen uptake, vertical jump, and isokinetic strength tests also produced the most significant changes in mood state profiles, as measured by the POMS (McNair, 1971). At the end of the taper period these cyclists displayed heightened Vigour, and lowered Fatigue and Depression. Similar mood-state profiles were also obtained in a study of elite American cyclists (Hagberg, Mullin, Bahrke, and Limburg, 1979). The cyclists who did not exhibit performance increments also showed a consistent pattern in mood-states from pre-taper to taper periods. On the basis of these findings it could be speculated that the POMS profiles provide an indicator of performance expectancies.

The effects of overtraining on heart rate do not appear to be as distinctive as is generally thought (Chogovadze and Butchenko 1992). In a study of physiological responses to intensified training 7 male competitive cyclists were subjected to 2 weeks of heavy training (Jeukendrup, Hesselink, Synder, Kuipers, and Keizer, 1992). The study covered 3 periods each lasting 2 weeks. The first period involved training at a moderate intensity. The second involved mainly high intensity interval training. The third was a period of reduced training and was considered to be a recovery phase. After 2 weeks of intensive training all cyclists displayed symptoms of overtraining. Performance, as indicated by time-trial times and maximal power outputs, declined significantly. Actual competition performance also declined, as only one of the 7 cyclists completed an event after 2 weeks of intensified training, whereas during the period of moderate training all cyclists finished in the first 20. Sleeping heart rate increased significantly, and maximal heart rate during the time trial was significantly lowered. There were no increases detected in morning heart-rates over the duration of the study. Consequently, Jeukendrup et al concluded that sleeping heart-rate was a better indicator of overtraining than morning heart rate.

However, other studies have detected changes in morning resting heart-rate following intensified aerobic training. Dressendorfer, Wade, and Scaff (1985) measured the morning heart-rates of 12 runners who ran twice their regular training distance for 20 days while they were competing in a 500 kilometre road race. During the first 8 days the increases in morning heart rate were not significant. However, from day 8 to day 20 all subjects showed significant increases in morning heart rate, whereas no significant changes were detected on measures of systolic or diastolic blood pressure. Running performance was 15% poorer than their best marathon times and/or their usual training times. Furthermore, the changes in morning heart-rate were not significantly correlated with any of the other measures taken. Dressendorfer et al concluded that athletes should log their morning heart-rates, with increases of over 10 beats per minute over their average to be regarded as an indicator of overtraining.

At this point there seems to be some disagreement about the effects of overtraining on resting heart-rate. Dressendorfer et al (1985) found clear evidence that implicates increases in training distance as a contributor to increases in morning heart rate, while Verde et al (1992) failed to detect such a relationship. The different findings cannot be attributed to the nature of the activity undertaken as Verde et al also tested distance runners without finding any increases in heart-rate. Neither study looked at sleeping heart rate which was found to increase following intensified interval training, whilst resting morning heart rate showed no such increase (Jeukendrup et al, 1992). It may be that the effects of overtraining are mediated by the anaerobic/aerobic nature of the activity in that increases in heart-rate are due more to increases in aerobic or anaerobic training load. Given that, within each of the studies, training volume and/or intensity was standardised, it would be expected that all subjects would be exposed to similar training intensities. Thus, each subject would be undertaking either an aerobic or an anaerobic training increase, depending on the type of training stimulus imposed. However, there exists the possibility of inter-subject variability with regard to whether a given degree of training load is experienced as aerobic or anaerobic (Janssen 1987). Consequently, within the Jeukendrup et al, and Verde et al, studies, any athlete may have been subjected to either an aerobic or anaerobic increase in training load depending on their physiological propensity to experience a given training load as either aerobic or anaerobic.

A study by Hunter, and McCarthy (1983) looked at the blood-pressure and heart-rate responses on 8 competitive cyclists following high-intensity anaerobic training. Training intensity was increased for a period of eight weeks which was divided into two-four week programs; a high-intensity bicycle ergometer interval program, and a weight training program. All subjects undertook both programs. Testing occurred at the beginning of the program, after four weeks of training, and again after the last four weeks of training. Resting heart-rate decreased, while performance increased significantly from the pre-training program. As hypothesised, blood-pressure increases and mood-state changes were associated with the high-intensity training. However, only systolic blood-pressure increased significantly, and of the six mood variables assessed using the POMS (McNair et al 1971), only Fatigue increased significantly as compared with the pre-training program. Of particular interest were the variations within the individual mood-states that related closely to the blood pressure measures. The cyclists with the most extreme pressor response also tended to decrease the most in Vigour and increase the most in Fatigue. The within-subject blood-pressure correlations with the POMS Vigour and Fatigue scales reflect the findings of Pyke et al (1988), who found that the cyclists who benefited most from the tapering schedule demonstrated heightened Vigour and lowered Fatigue and Depression at the end of the tapering period as measured with the POMS.

On the basis of the above-mentioned studies, which looked at the effects of overtraining on various psychological and physiological measures, it would seem that the most reliable measure of overtraining is the POMS (McNair et al, 1971). The questionnaire may also provide an indirect indicator of performance, as increases in Fatigue and decreases in Vigour were associated with performance decrements in some subjects in the Pyke et al (1985) study. Heart-rate may provide a measure of overtraining. However, this view is not consistently supported (Verde et al, 1992., Jeukendrup et al, 1992., Dressendorfer et al, 1985). The effect of overtraining on blood-pressure is rarely assessed. In the few studies to do so, increases in blood pressure were associated with decreases in resting heart rate. Hunter and McCarthy, (1983) as mentioned above, and Morgan (cited in Hunter et al, 1983), found this relationship in swimmers.

The detrimental effects of overtraining need to be prevented. The most obvious method would seem to be to utilise the POMS (McNair et al, 1971), and adjust training loads accordingly. A commonly suggested prescription is rest, accompanied by reduced training load, or a complete break from training. The obvious problems with this approach are the time requirements of resting, and the loss of fitness. Consequently, coaches and athletes are faced with a quandary. The solution may be to provide a means by which the detrimental effects of overtraining may be prevented, while at the same time, allow the athlete to continue training at a desired level. What is required is a treatment that relaxes the athlete to the extent that s/he displays the "iceberg" profile on the POMS; below average scores on the Tension, Depression, Anger, Fatigue, and Confusion scales, and approximately one standard deviation above the population average on Vigour. Findings such as these have been consistently noted for swimmers (Morgan, 1985). As indicated by Pyke et al (1988), profiles such as these are an indication of optimal performance potentials.

The need for an effective relaxation treatment stems not only from the physiological and psychological effects of overtraining, but also from the need to reduce the athlete's susceptibility to injury, and to achieve mood states in which the athlete is both relaxed and alert, as these states have been associated with optimal performance levels. The methods most commonly used are progressive muscle relaxation, mental practice, and hypnosis (Ogilvie, 1979).

Relaxation Treatments

Mental Practice

Mental practice does not appear to be considered by Feltz and Landers (1983) to be an appropriate method of inducing relaxation. A perusal of the mental practice studies covered in their meta-analysis failed to detect any studies that examined its effects on relaxation. Given the lack of empirical and anecdotal evidence, there does not appear to be any reason to think that mental practice facilitates relaxation, and/or contributes to the control of any of the physiological variables mentioned above.

Hypnosis

The interest in the application of hypnosis to the sports setting largely resulted from claims of extraordinary improvements in muscular strength by hypnotised subjects (Moll, 1958). Hypnosis is probably best described as an alternative state of consciousness Unestahl (1986). Or as stated by Ryde (1964) " A state of suggested relaxation, in which the subject becomes amenable to the suggestions of the hypnotist".

Hypnosis has been used to manage the dehabilitating levels of anxiety of athletes (Pressman, 1979). This seems hardly surprising, since relaxation is an essential part of the induction procedure (Bond, 1986., Edmonston, 1981). In the domain of Sports Psychology, hypnosis has obvious benefits with respect to the performance-arousal relationship. However, as has seen from much of the research on the performance arousal relationship, lowered levels of anxiety are not necessarily precursors of improved athletic performance (Wojcikiewicz & Orlick, 1987).

In a direct comparison between the hypnosis and the meditation-induced relaxation response Benson, Frankel Apfel, Daniels, Schienwind, Nemiah, Sifneos, Crassweller, Greenwood, Kotch, Arms, and Rosner (1978) found that in subjects presenting anxiety symptoms, the two treatments were almost identically effective. Assessment was through psychiatric interview, a self-assessment scale, and the physiological measures of blood pressure, oxygen consumption, and heart-rate. The major contribution of the Benson et al study is that it provides one of the few studies that have directly compared the two groups. Other studies eg., (Deabler, Fidel, Dillenkoffer, & Elder, 1973) that have compared the effectiveness of similar techniques on measures of blood pressure have not provided a direct comparison. In the Benson et al study hypnosis consistently resulted in lower blood-pressure readings as compared to progressive muscle relaxation, although in all except one of their evaluations the reductions over sessions were notably similar. Furthermore, relaxation always preceded hypnosis in the treatment sessions, so there is no way of determining whether relaxation did not contribute to the obtained effects (Edmonston, 1981).

The claimed effectiveness of hypnosis in improving muscular strength stems primarily from case studies and anecdotal reports (Onestak, 1991., Bond, 1986). The empirical evidence supporting the effectiveness of hypnosis in improving muscular strength has been criticised on a number of grounds. These centre mainly on the confounding effects of motivational instructions. In the absence of motivational instructions, hypnosis has not been demonstrated to improve physical performance (Johnson, 1976; & Morgan & Brown, 1983).

A prerequisite for practicing hypnosis is registration as a psychologist under the Psychological Practices Act (Bond, 1986). It is not always possible to have the services of a qualified hypnotist. The need for a qualified practitioner somewhat diminishes its appeal as a reliable tool for relaxation. Furthermore, in relation to the current study, no evidence appears to exist which suggests that hypnosis may promote the mood of athletes in the desired direction as indicated by the specific measurements relative to the sports setting (POMS, McNair et al 1971; SCAT, Martens, (1977). Given the above considerations, hypnosis, in spite of its extensive and varied applicability, was not considered to be an appropriate technique for relaxing athletes, and/or overcoming the effects of over-training.

Progressive Muscle Relaxation

Progressive relaxation refers to a technique developed by Jacobson (1938) whereby a deep state of muscle relaxation is obtained. The technique requires the contracting of specified muscles with the emphasis placed on feeling the tensions that are produced. Then the muscles are relaxed, and again the individual focuses on the feelings associated with this muscle state. This procedure is repeated systematically in relation to a sequence of muscle groups until a general state of relaxation is achieved. The basic premise of this technique is that there is a direct connection between the muscular system and the emotions (Fisher, 1976). If so, this technique may provide a means of achieving both mental and physical relaxation.

The extent to which Progressive Muscle Relaxation lowers anxiety was investigated by French (1978). Groups matched on stabilomotor balancing skill were randomly assigned either to a control group or to groups employing progressive relaxation, autogenic training, or electromyographic (EMG) biofeedback techniques. While the experimental groups displayed lower levels of anxiety than the control group, no differences in stabilomotor performances appeared. Similarly, Griffiths, Steel, Vaccaro, and Karpman (1981), assessed the effects of biofeedback relaxation, which emphasised muscle relaxation, and of meditation, as compared with a control group on an underwater assembly task performed by novice scuba-divers. The two treatment groups displayed significantly lower state anxiety than the control group. No significant performance differences were found between groups, although both state and trait anxiety showed significant negative correlations with performance. This finding suggests that high levels of anxiety are detrimental to performance, and that state anxiety might be lowered by a muscle relaxation program.

Athletic performance increases, and reductions in competitive anxiety, were obtained in volleyball players following relaxation training (Lanning & Hisanaga's, 1983). Twenty-four players were randomly assigned either to a Progressive Muscle Relaxation program or to a control condition. Anxiety was assessed using the Sport Competition Anxiety Test (SCAT) developed by (Martens, 1977). The SCAT was completed by each subject three times; at pre-treatment, following treatment, and at the end of the season. The treatment by time interaction was significant in relation to anxiety and also to performance measures. Given the findings of Griffiths, Steel, Vaccaro, &Karpman (1981), and Lanning and Hisanaga (1983) it seems that progressive relaxation procedures do reduce anxiety. However the extent to which there are concomitant improvements in performance still remains unclear. Similar conclusions were expressed by Onestak (1991) in his review.

The relaxation response of Progressive Muscle Relaxation (PMR) was investigated by Kaplan and Barabasz (1988). The dependant measure was the Stanford Hypnotic Susceptibility Scale, Form C, which assesses the hypnotisability of persons through relaxation induction techniques. Progressive Muscle Relaxation was compared with Flotation restricted environmental stimulation (REST). Comparable increases on hypnotisability scores were obtained between the Progressive Muscle Relaxation and the Flotation Rest groups, which indicates that both treatments are similar with regard to enhancing relaxation. The increase were significant compared to the control group.

The state of muscle relaxation may also lower an athlete's susceptibility to injury, by allowing greater flexibility. The flexibility development in sprinters was assessed by Cummings, Wilson, and Bird (1984) using EMG biofeedback and relaxation training .Sprint performance improved for all groups, including the control, which engaged in stretching exercises. Flexibility gains were consistent across all groups during the treatment period of 4 weeks. However, during the retention period, weeks 6 to 8, superior flexibility gains were obtained for the EMG biofeedback and relaxation groups only. Cummings et al conclude that benefits of the two treatments may be important, as increased flexibility has been associated with a lower probability of muscle injury.

Progressive relaxation has also been demonstrated to reduce blood pressure (Frumkin, Nathan, Prout, & Cohen, 1978).

One of the benefits of the Progressive Muscle Relaxation technique is its simplicity. Its application does not require any specific skills on the part of the user, nor is there a need for trained personnel for instruction, and it can be used at any time, virtually provided the recording facilities are available. These features, along with its claimed performance enhancement and anxiety lowering features, make it a technique worthy of further investigation as an athletic aid.

Flotation Rest

Recently the Flotation Rest method has emerged as a reportedly effective technique for a variety of applications which essentially require stress management. The success of the technique has promoted research on its applicability in the field of sport psychology (Krakauer, 1986). Recently a small body of evidence has emerged which suggests that flotation tank treatment, usually referred to as Flotation Rest (REST) improves athletic performance. To be consistent with the literature, and despite its slightly anomalous nature, this report will use the (REST) abbreviation. Anecdotal evidence also indicates that Flotation Rest reduces injuries caused by overtraining or muscular tension, and is an effective method of recovery from the stress of peak output (Hutchison, 1984).

The main focus of the studies that have assessed the benefits of Flotation Rest on athletic performance has been the comparison of Flotation Rest with Imagery. The performances of occasional basketball players were assessed following one session of either Flotation Rest plus Imagery, an alpha chair plus Imagery, or a control condition, also with Imagery by Suedfield and Bruno (1990). Flotation Rest resulted in significantly higher performance scores than either of the other conditions. The generalisability of the study is limited, in that the players were not regular competitors, the performance measures were not obtained in actual competition, and there was only one treatment session.

Nevertheless, Barabasz and Barabasz (1991) found greater improvements in basketball performance scores in expert college players who had engaged in Flotation Rest plus Imagery than in the players who engaged in Imagery-only. The advantages of this study were that the performance measures were obtained in actual competition using subjective and objective measures, and there were six treatment sessions in each condition. Barabasz and Barabasz concluded that Flotation Rest appeared to increase the effectiveness of Imagery training.

The performance-enhancement effects of Flotation Rest have been studied in other sporting disciplines. Expert intercollegiate tennis players were assigned to either a Flotation-Rest-with-Imagery group or an Imagery-only group in a study performed by McAleney, Barabasz, and Barabasz (1990). Subjects were exposed to six 50 minute treatment sessions in their assigned treatments, over a 3 week period. Significant differences were found only on first service scores. As the first-serve measures were seen to reflect a highly controlled skill which was less variable than the other performance measures taken, it was suggested that Flotation Rest may be used to enhance the performance of a well-learned skill by athletes of high ability.

In the above-mentioned studies Flotation Rest was, in each case, combined with Imagery, therefore the extent to which Flotation Rest by itself enhances performance was not addressed. Suedfeild, Collier, and Hartnett (1993) addressed this issue by comparing the effects on dart-throwing scores of Flotation Rest only, Imagery only, Flotation Rest plus Imagery, and a control group . Subjects were exposed to only one treatment session which lasted for 1 hour. The results supported the efficacy of Flotation Rest as a performance enhancing technique, as dart-throwing accuracy following

Flotation Rest improved regardless of whether the subject was exposed to Imagery in combination with Flotation Rest. The measures used in this study imply that the effects found in the other performance assessment studies which used Flotation Rest combined with Imagery were more likely to be attributed to the Flotation Rest effects rather than the Imagery effects.

Flotation Rest may also reduce an athlete's susceptibility to injury. Preliminary evidence in support of this notion stems from a study which examined the effects of Flotation Rest plus Imagery, compared to Imagery only, and a control group, on measures of gymnastic performance and on physical symptoms (Lee and Hewitt, 1987). Physical symptoms were determined via a 34 item questionnaire which contained items concerned with athletic injuries and general ill-health. The six sessions, which lasted for 40 minutes, took place on a weekly basis. Subjects were pre-tested on the Alpert and Haber's Achievement Anxiety Test (1960). The test, which was modified so as to be applicable to gymnastic performance, assesses whether an athlete is high or low on measures of facilitating/debilitating anxiety. "Facilitating anxiety" refers to the extent to which the athlete feels that anxiety assists them in competition. Lee and Hewitt considered that it would be reasonable to expect that high debilitating anxiety would be predictive of sports injury, and that treatments designed to improve performance and reduce stress would also reduce the probability of physical symptoms developing. The results showed that those with high facilitating anxiety had higher state qualifying scores, and that subjects exposed to the Flotation Rest condition also had higher scores than either of the other groups. Somewhat surprisingly, high facilitating anxiety scores were also associated with higher physical symptoms scores. The findings imply that successful athletes, as indicated by their higher performance scores, are more likely to be susceptible to injury or general ill-health, or to perceive and report their conditions differently.

Several studies have assessed the effects of Flotation Rest on physiological and psychological indices of stress. Case studies have concluded that the Flotation Rest significantly lowered blood-pressure in borderline hypertensives (Fine & Turner, 1982), and that these changes persisted for up to 9 months (Kristeller, Schwartz, & Black, 1982).

These findings were extended to larger samples of normotensive subjects, with similar results. Jacobs, Heilbronner, and Stanley (1984) assigned 28 volunteers either to a treatment condition, in which they practiced a guided relaxation program in a flotation tank over ten 45 minute sessions, or a control condition where the same relaxation program was practised in a normal sensory environment. Of the physiological measures assessed, significant findings were obtained only for blood-pressure. Both systolic and diastolic blood-pressure were significantly reduced in the experimental group. In relation to the psychological measure of relaxation, the experimental group reported both greater general relaxation and more overall muscle relaxation. The experimental group reported both greater general relaxation and more overall muscle relaxation. Jacobs et al, did not have a Flotation-only group. Therefore, it is possible, that Imagery in combination with Flotation Rest might be associated with the obtained reductions in blood-pressure. Of interest was the finding that the control group showed significant decreases on diastolic blood pressure on the within-group comparison of pre-test and post-test means. This finding did not extend to systolic blood-pressure. This may imply that systolic blood pressure is less resistant to change.

Concomitant effects of Flotation Rest on physiological and psychological measures were obtained by Turner, Fine, Ewy, Sershon, and Freundlich (1989). Twenty one healthy volunteers engaged in Flotation Rest over eight sessions, either with lighting or in darkness. Both groups showed significant decreases in blood pressure. There was no difference between groups in pooled values of blood-pressure. The Profile of Mood Scale (POMS) was administered before and after the first and last treatment sessions. An overall improvement in mood was demonstrated for both conditions. This effect seemed to be greater for the Flotation Rest dark condition, as a significantly greater improvement appeared in session one for this group.

While the overall improvement in mood is impressive, in order to recommend Flotation Rest as a method of mood enhancement for athletes it would be necessary to demonstrate heightened Vigour and lowered Fatigue on the POMS sub-scales, as these are characteristic of the iceberg profile seen in suitably aroused athletes. These effects were obtained after only one Flotation session on a population of undergraduate psychology students (Forgays & Forgays, 1992). Subjects exposed to Flotation Rest showed more reduction in Tension, Depression, Hostility, and Fatigue scores than did the controls. Furthermore, increases in Vigour were demonstrated for the Flotation Rest group, while the controls showed a decrease. Forgays and Forgays suggest that the flotation environment may produce a relaxed but alert state. As such mood states were considered by Nideffer (1976) to be optimal for athletic performance, and also seen as indicators of appropriate training levels (Morgan et al, 1987; Verde et al, 1992; Pyke et al, 1988, & Hunter & McCarthy, 1983) it would seem reasonable to consider Flotation Rest as an effective athletic aid.

However, the desired POMS profile was not obtained in a similar study which compared wet and dry flotation environments. In a dry flotation environment the user is not in direct contact with the salt solution, but rests on a waterbed mattress filled with water located in a tub like container similar to the wet flotation tank. Forgays, Forgays, Pudvah, and Wright (1991) assessed the effects of the two environments on 24 undergraduate students over two 60 minute float sessions. A MANOVA which analysed the six POMS scales, the three State Personality Inventory (SPI) scales, and the heart-rate measures failed to detect any pre/post differences for the six POMS scales. For the SPI scales, only females showed a close to significant decrease in anxiety from pre-test to post-test. Both environments were associated with significantly lower heart-rates.

Wet flotation environments appeared to produce somewhat superior positive changes. This was more the case for females as their heart-rate decreased more than those of males from pre-test to post-test. Why Forgays and Forgays (1992) obtained the desired POMS profile, and Forgays et al (1991) did not, is unclear. The studies used similar samples, and the difference in the number of trials for each subject should not have produced such different findings.

Despite the prevailing belief that Flotation Rest is a relaxing experience, a study comparing Flotation Rest to a quiet room found that subjects tended to be more aroused when immersed in water than when in the room (Forgays & McClure, 1974). The tank group showed significantly higher heart rates than the subjects in the quiet room. The strength of these findings is questionable, as the Flotation Rest treatment condition was not typical of the methods in current use. The tank did not contain the required salt concentrations, and the subject was therefore suspended by a harness in order to remain afloat. Furthermore, even though the session could be terminated at any time by the subject, each trial lasted for up to 360 minutes. Given these considerations it would seem unwise to consider these findings as constituting evidence against the prevailing beliefs regarding Flotation Rest

So far most of the research concerned with Flotation Rest has looked at the treatment combined with Imagery (Suedfeild & Bruno, 1990; Lee & Hewitt, 1987; Suedfeld et al, 1993; McAleney et al, 1990; & Barabasz & Barabasz, 1991) in various forms. In the studies that have used measures relative to sport psychology, the findings suggests that the Flotation Rest treatments promotes relaxation , as indicated by POMS scores (Turner et al, 1989; Forgays & Forgays, 1992) lowered blood pressure readings (Turner et al, 1989; Fine & Turner, 1982: & Kristeller et al, 1982) and lowered heart rates (Forgays et al, 1991).

Nevertheless, only one study which compared Flotation Rest with techniques such as Progressive Relaxation found Flotation Rest to be superior (Jacobs et al, 1984).

However, the method of progressive relaxation adopted by Jacobs et al was modified to include breathing techniques and Mental Imagery. Thus the effect of Progressive Relaxation may not have been partitioned out to show the extent to which it alone may induce relaxation. Evidence supporting the notion that Progressive Muscle Relaxation may be comparable to Flotation Rest stems from a study which looked at the differential effects on hypnotisability of the two treatments (Kaplan & Barabasz, 1988). Given that a state of relaxation is a prerequisite to being hypnotised, it would seem reasonable to assume that the findings of Kaplan and Barabasz are relevant to the current study. The 30 subjects, assigned in equal numbers to the treatment or the control groups, each underwent two sessions in their respective condition. In the control group subjects were required to spend an equivalent amount of time, to the experimental groups, in a large room. All of the subjects assigned to the control condition were present during each session. They were allowed to read or relax, but they were not permitted to interact with each other. The results indicated that Flotation Rest was no more effective than Progressive Muscle Relaxation in increasing hypnotisability. However, both treatment conditions enhanced hypnotisability significantly more than did the control condition.

In the light of the similar relaxation responses following exposure to Flotation Rest and Progressive Muscle Relaxation obtained by Kaplan and Babarasz (1988) it would seem reasonable to suppose that the two treatments may have similar effects on other measures that are of interest to the sports psychologist-specifically the POMS (McNair et al, 1971) and physiological indices such as blood pressure (Hunter & McCarthy, 1983; & Chogovadze & Butchenko, 1992)-both of which have been shown to be indicators of excessive training (Morgan, et al, 1987; & Verde et al, 1992). Increases in morning heart-rate have been associated with overtraining (Dressendorfer et al, 1985). Flotation Rest has been shown to bring about reductions in heart-rate (Forgays et al, 1991). This suggests that Flotation Rest has the potential to counteract the heart-rate effects associated with overtraining.

The literature on Flotation Rest and Progressive Muscle Relaxation suggests that no study has yet directly compared the effects of the two treatments on competing athletes. Nor have any of the previously used indicators of relaxation, such as the POMS (McNair et al, 1971) blood pressure, or heart rate been examined in regard to competing athletes following exposure to the two treatments. Not only would the comparison be of interest from a scientific viewpoint, but should the two treatments have similar effects, it would provide athletes with another option besides Flotation Rest. Given the portability and simplicity of the Progressive Muscle Relaxation technique it has obvious practical advantages over Flotation Rest. Moreover, should either treatment enhance the mood states of athletes, it could be anticipated that performance gains would follow.

Hypotheses

The current study, then, attempts to compare the effects of the two treatments on a sample of competitive cyclists. Based on the findings of previous studies that have found reductions in blood pressure (Fine & Turner, 1982: Jacobs et al, 1984; Kristeller et al, 1982; & Turner et al, 1989;) it was hypothesised that both systolic and diastolic blood pressure would be lower following Flotation Rest than following Progressive Muscle Relaxation. It was further hypothesised that the cyclists would display the iceberg POMS (McNair et al, 1971) profile following Flotation Rest, as Flotation Rest has been demonstrated to bring about changes in POMS scores (Turner et al, 1989; & Forgays & Forgays, 1992). Flotation Rest was also expected to reduce heart-rate more than would Progressive Muscle Relaxation, given the findings of Forgays et al (1991).

The effects of Flotation Rest and Progressive Muscle Relaxation have not been studied in relation to sport specific competition anxiety. Muscle relaxation has been shown to reduce state-anxiety, and state- and trait-anxiety has been shown to negatively correlate with performance on an underwater assembly task (Griffiths et al, 1981).Individual differences in anxiety have been shown to influence basketball performance (Sonstroem and Bernado, 1982). The best performance scores were associated with moderate levels of state-anxiety as measured by the Sports Competition Anxiety Test (SCAT Martens, 1977). Anxiety has also been implicated by Nideffer (1981) in the sports-injury relationship as a contributing factor to increases in an athlete's susceptibility to injury. Given that anxiety has been associated with performance and injury, there is a need to assess the effects of relaxation treatments that may be effective in reducing it. By providing an anxiety measure, such as the Sport Competition Anxiety Test (SCAT) in this study, this need may be met. The success of Flotation Rest across a broad range of applications (Hutchinson, 1984) suggests that it may be effective in lowering anxiety in athletes. On this basis it was hypothesised that the Flotation Rest treatment condition would lower anxiety more than would Progressive Muscle Relaxation treatment.

Method

Subjects

Subjects were competitive cyclists living in Adelaide, who had volunteered to participate in a study on relaxation. From an initial sample of 20 subjects, five withdrew from the study because of personal commitments. Of the remaining 15 subjects, seven were randomly assigned to the Flotation Rest condition, and eight were assigned to the Progressive Muscle Relaxation condition. Ages ranged from 16 to 57 years with a mean age of 34.2 years. The Flotation Rest group had six males and one female, and had a mean age of 34.8 years. The Progressive Muscle Relaxation group had eight males with a mean age of 33.6 years. All subjects were currently competing in club level competition, and of these, four were competing at the national level. On average each cyclist completed 425 kilometres per week in training and competition. Four subjects were affiliated to the South Australian Sports Institute, eight to the Norwood Cycling Club, and three to the Veterans Cycling Club.

Apparatus

Flotation tanks.

The flotation tank is made of fibreglass, and is approximately eight feet long by four feet wide by 42 inches high. Entry is through a sliding door at the side of the tank. The door has a handles on both sides, allowing the subject to enter and leave at will. The tank contains a dense solution of water and epsom salts heated to approximately 94.0 ± 0.5 F. The density of the solution allows the subject to float effortlessly on top of the water. No light can enter the tank once the door is closed. The tank contains a complete water filtration and purification system. An intercom system located directly opposite the door allows the subject immediate access to the experimenter at any time. Each tank is located in a separate room which contains a shower and changing facilities (see Appendix A)

Progressive muscle relaxation tapes

The Progressive Muscle Relaxation tapes were based on the Jacobson (1938) muscle relaxation technique. Essentially the tapes direct the subject to systematically contract and relax specified muscle groups. The subject is requested to focus on the feelings following each movement. The tapes were played on a conventional portable stereo tape player in a darkened room while the subject lay fully clothed in a supine position on a bed.

Physiological measurements

An Omron Automatic Digital Blood Pressure Monitor Model HEM-703C unit was used to obtain blood pressure, and heart rate measurements. The unit was calibrated against a mercury sphygmomanometer to ensure accuracy

Psychometric assessments

The Profile of Mood Scales (POMS, McNair et al, 1971) has been shown to be effective in detecting mood changes associated with excessive training and tapering in swimmers (Morgan et al, 1987). Flotation Rest has been shown to alter mood (Turner et al, 1989; & Forgays & Forgays et al, 1992) in samples of non-athletes. The POMS is available in versions measuring mood over one day, and one week. In order to assess whether Flotation Rest has the potential to counter the effects of excessive training, the "one-week" POMS was administered.

Anxiety has been associated with an athlete's susceptibility to injury (Nideffer, 1981). Measures of competitive sports anxiety are obtainable through the Speilberger Sport Competition Anxiety Test (SCAT; Martens, 1977). The SCAT was used in this study in order to assess whether Flotation Rest reduces a cyclist's anxiety in relation to the sports setting.

Procedure

The purpose of the study, to test for any relaxation responses following exposure to either treatment, was explained to all subjects during briefing. Subjects were asked to volunteer, without obligation, for a period of approximately eight weeks. Each subject completed an informed consent form. For subjects under 18 years of age, the consent form was signed by a parent or guardian. Confidentiality was assured both in writing and on the consent form (see Appendix B). Subjects were roughly matched into pairs on age and then randomly assigned into the two conditions on the toss of a coin. The 15th subject was assigned to a condition using the same method.

Testing was conducted on a weekly basis at the South Australian Sports Institute, Kidman Park Adelaide, on either a Monday or Friday afternoon. These days were chosen as they coincided with rest days incorporated in the cyclists training programs. Initially, each subject underwent two familiarisation sessions in order to become accustomed to their respective treatment condition, as some people find that the novelty of the flotation tanks prevents them from relaxing fully. Prior to the first familiarisation session, baseline physiological measurements of blood pressure and heart rate were obtained by the experimenter. The monitor used to obtain these measurements requires no special training on the part of the experimenter. Every physiological recording throughout the experiment was based on the average obtained from three readings taken two minutes apart. Actual testing began on the third session and ran through to the eighth session. Each session in both conditions lasted for 45 minutes.

The measurements of blood pressure and heart rate were taken prior to the commencement of, and immediately following each session. For the Flotation Rest condition measurements were taken before the subjects showered. The post-test measures were taken while the subjects were still in the flotation tanks. This procedure was conducted because it was felt that if measurements were taken after the subjects had showered, the readings might be effected by the shower. Obtaining the measures immediately following the Flotation Rest session eliminated this possible confounding factor, and also ensured that there was no difference in the time-gap between the termination of the sessions and time of measurement, between the two treatments.

The POMS (McNair et al, 1971) and the SCAT (Martens, 1977) were administered prior to commencement of the third session and following the completion of the eighth session, thus yielding pre- and post-experimental psychological assessments. The reason for administering the POMS and the SCAT questionnaires only on those occasions was that due to the time commitments of the subjects, it was felt that the added time needed to complete the questionnaires might lead to less careful completion. Similar reservations were expressed by Jeukendrup et al (1992) who claimed that the length of the POMS made it somewhat unsuitable for daily administration. As each testing session tended to run for close to 1-and-one-half hours for the Flotation Rest subjects, due to the added time required for showering, adding the questionnaires at each session would have lengthened the session considerably. Another possible procedure would be to administer the tests prior to, and immediately following, the first and sixth sessions. The procedure of the current study was adopted by Turner et al (1989) in order to assess the effects of Flotation Rest across individual sessions. The purpose of this study is to extend their findings by looking at the effects of Flotation Rest on mood and anxiety across the experimental period. Administering the "one-week" POMS at the beginning and the end of the experiment may detect changes in the way subjects perceive their mood over the experimental period as opposed to a day.

At the final session subjects were given the Subjective Evaluations Questionnaire which contained four open-ended questions asking them what they thought of the Flotation Rest/Progressive Muscle Relaxation experience, how their muscles felt during the sessions, what their expectations were of the experiment, and how, if at all, they felt that their feelings effected the way they performed? The questionnaire was a late addition to the study. At the time of its introduction five subjects had completed the necessary number of sessions and had retired from the experiment. Of these, three were lost to follow-up and two were given the questionnaire but failed to return it. Thus there are only ten questionnaires.

Results

Three separate multivariate analyses of variance (MANOVA) were performed to test for differences in before - and after-treatment session readings across the six weeks, on diastolic and systolic blood-pressure, and heart-rate. There were two within-subjects factors; the pre-test and post-test measures, and time, which had six levels. The pre/post factor refers to the difference between the averages of the pre-test scores and the averages of the post-test scores. The six levels corresponded to the treatment sessions. The two treatment conditions Flotation Rest, or Progressive Muscle Relaxation were the between subjects factors. Orthogonal polynomial contrasts were performed on the pre-test and post-test measures to test for linear, quadratic, and quartic trends.

Two 2 x 2 analyses of co-variance (ANCOVA) were conducted for the POMS (McNair et al, 1971) scores using the data obtained prior to the first treatment session and data obtained following the final treatment session. No baseline mood measures were obtained, consequently the pre-test heart rate measures were used as the co-variate for these variables. Because of unequal sample sizes, multiple classification analyses were performed, which provided adjusted and unadjusted means for each condition. The unadjusted means represent the means without adjustment for how they would have looked like had they not differed on the co-variate. The unadjusted means and standard deviations are reported in Table 1. T tests were conducted on the POMS scores and the SCAT (Martens, 1977) scores in order to detect any changes from pre-test to post-test measures.

The results are presented in the following order;

The results of the MANOVA for blood pressure and heart-rate are presented first. Second, the results of the ANCOVA and the t tests conducted on the POMS (McNair et al, 1971) total mood scale scores and sub-scale scores are reported. Third, the results of the t-tests performed on the SCAT (Martens, 1977) scores. Fourth, the responses to the Subjective Evaluations Questionnaire are reported.

Table 1

Means and Standard Deviations of Physiological Variables for Flotation Rest or Progressive Muscle Relaxation Conditions on Pre-test and Post-test measures.

Cond	Dep/Var	Pre-Test		Post-Test	
		Mean	SD	Mean	SD
REST	Syst	120.08	(12.81)	111.24	10.25)
PMR	Syst	125.84	(9.26)	122.12	(8.70)
REST	Diast	71.47	(10.41)	60.09	(8.64)
PMR	Diast	77.84	(12.43)	79.21	(10.49)
REST	H/Rate	65.80	(7.38)	58.84	(5.40)
PMR	H/Rate	59.76	(9.24)	55.68	(9.69)

Note . Unadjusted means are reported.

Physiological Measures

Systolic Blood Pressure

Significant main effects were obtained on the pre/post-treatment systolic blood pressure readings F(1,13) = 18.09 p< .001. Pre/post refers to the difference between the averages of the pre-test scores and those of the average post-test scores. Systolic blood pressure was significantly lower on post-treatment readings than on pre-treatment readings. The polynomial contrast conducted for time revealed a significant pre/post-treatment by time interaction F (1,13) = 4.73, p < .049. This indicated that for both conditions the reductions in the post-test measures of systolic blood pressure became greater across sessions. The interaction of treatment condition by pre/post by time did not reach significance, F(1,13) = 2.63, p < .129 (see Figure 1).

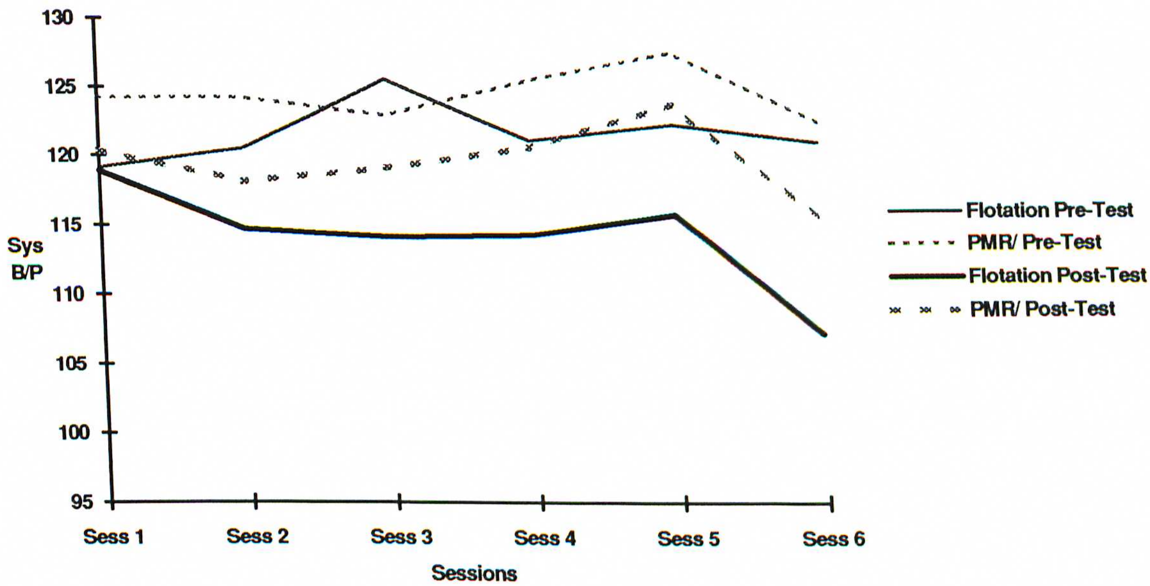


Figure 1. Mean Pre-treatment and Post-treatment Systolic Blood Pressure Readings for Flotation Rest and Progressive Muscle Relaxation Conditions

Diastolic Blood Pressure

Significant main effects were obtained for pre/post treatment diastolic blood pressure readings, F(1,13) = 15.02, p < .002. A significant treatment condition by pre/post-treatment interaction occurred F(1,13) = 6.65, p < .023. This indicated that diastolic blood pressure was lower following Flotation Rest than following Progressive Muscle Relaxation. The linear polynomial contrast showed a significant pre/post-treatment by time interaction $F(1,13) = 10.34$, $p < .007$. The significant condition by pre/post-treatment by time interaction, $F(1,13) = 7.81$, $p < .015$, indicated that the reduction in diastolic blood pressure became greater the more Flotation Rest sessions the subject underwent. (see Figure 2).

The results presented in figure 2 show that for the Flotation Rest and Progressive Muscle Relaxation pre-test measures there were no significant changes in the readings obtained across the six sessions. The representation of the data for the Flotation Rest post-test measures shows that the reduction in the post-test Flotation Rest measures increased over the

sessions.

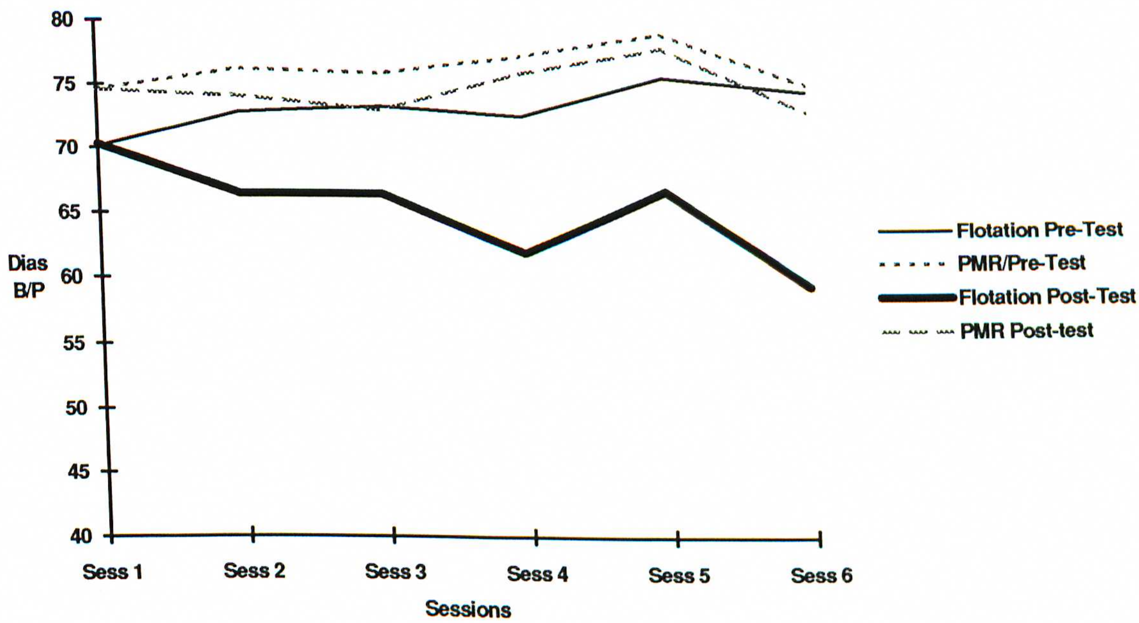


Figure 2. Mean pre-test and Post-test Diastolic Blood Pressure Readings for Flotation Rest and Progressive Muscle Relaxation Conditions.

Heart-Rate

Heart-rate was significantly lower on post-test measures than on the pre-test measures $F(1,13) = 25.12$, $p < .001$. This reduction in heart-rate could not be attributed to type of treatment condition as no condition by treatment interaction occurred (see Figure 3).

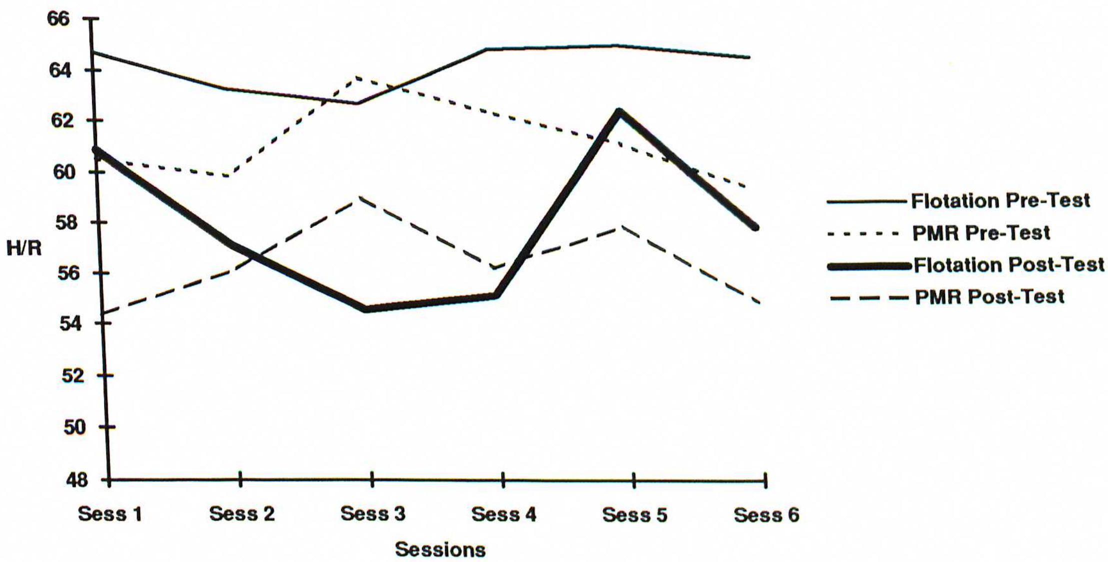


Figure 3. Mean Pre-test and Post-test Heart-Rate readings for Flotation Rest and Progressive Muscle Relaxation Conditions.

Summary of the Physiological Results

The results of tests on the physiological data show that for both conditions there were significant reductions in the pre-test to post-test readings on all of the variables tested. Only on measures of diastolic blood pressure were there differences between conditions, with the Flotation Rest condition having lower readings. The linear trends showing the reductions in the post-test measures over sessions suggests that there are cumulative effects of the treatment. This implies that the intra-session effects increases over sessions.

Psychometric Measures

Profile of Mood Scales

Profile of Mood scales were administered prior to the first treatment session and following the sixth treatment session. Mood was defined by the sum of all six factors in the scale, with Tension-Anxiety, Depression-Dejection, Anger-Hostility, Fatigue-Inertia, and Confusion-Bewilderment weighted positively, and Vigour-Activity weighted negatively. No significant main effects of mood were obtained for the POMS (McNair et al, 1971) scales

Related samples t tests using the POMS Total Mood Scores within each condition found no significant differences from pre-test to post-test for either Flotation Rest or Progressive Muscle Relaxation conditions (see Table 2).

Table 2

Profile of Mood States Total Score Means and Standard Deviations for REST and Progressive Muscle Relaxation Conditions

Condition	Co-variate	Pre-test		Post-test	
		Mean	SD	Mean	SD
REST	Pre-test H/R	183.02	(70.03)	190.78	(82.09)
PMR	Pre-test H/R	198.49	(63.63)	191.07	(60.11)

Note. Unadjusted means are reported.

Profile of Mood State Sub Scale Scores

No significant differences were observed between pre-test and post-test measures on any of the POMS sub-scale items (Tension, Depression, Anger, Vigour, Fatigue, and Confusion) for either Flotation Rest or Progressive Muscle Relaxation conditions. The POMS profiles of both groups were similar across pre- and post-test measures (see Figure 4). This profile resembles the iceberg profile, as noted by Morgan et al, (1987). In the Morgan study, swimmers who were subjected to an intensive training program, which was followed by a reduction in their training, exhibited higher scores on Vigour and lower scores on the remaining scales than the population mean scores for college student norms. The average POMS profiles of the subjects in this sample resembles that of the swimmers in the Morgan et al study in that the scores on all scales except Vigour, and Fatigue for the Flotation Rest group, were lower than the college student means for these scores The Vigour scores were higher than the population mean scores.

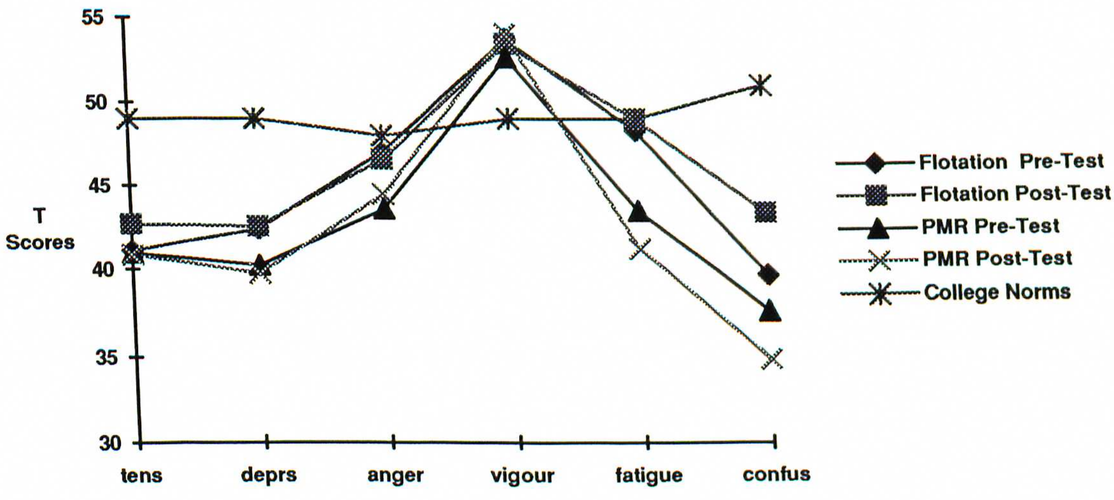


Figure 4 POMS Sub-scale Scores for Flotation Rest and Progressive Muscle Relaxation Conditions on Pre-Experimental and Post-Experimental Measures.

Sport Competition Anxiety Test

T tests conducted on the SCAT scores obtained prior to the first treatment session and following the final treatment session, revealed significant reductions on competitive A trait measures from pre-test ($\overline{X}$ = 497) (SD = 72.6) to post-test ($\overline{X}$ = 414.63) (SD = 99.6) for the Progressive Muscle Relaxation group only (t (7) = 4.03, $p <$ .005.) (See Figure 5).

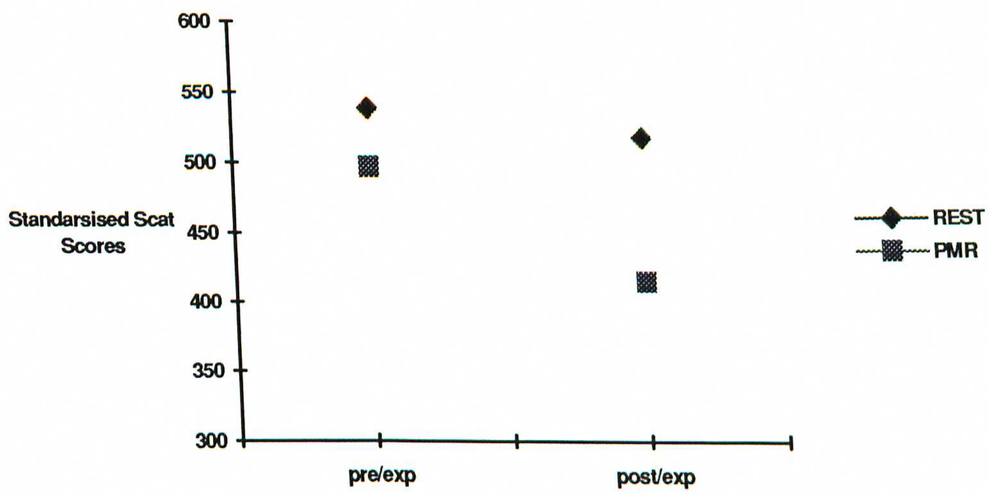


Figure 5 SCAT Scores for Flotation Rest and Progressive Muscle Relaxation on Pre-Experiment and Post-Experiment measures.

Subjective Evaluations Questionnaire

The Subjective Evaluation Questionnaires were filled out following the final treatment session. The responses were reported in terms of the number of similar comments made. Of the 15 subjects only 10 completed the questionnaires, seven out of the Progressive Muscle Relaxation group, and three out of the Flotation Rest group.

Q 1; How would you describe your experience of the relaxation tapes/flotation tank?

Progressive Muscle Relaxation Group.

All respondents in this condition reported that the tapes relaxed them and that they found them worthwhile. A common theme that emerged was that listening to the tapes made subjects feel much more aware of the state of tension within their bodies. One subject reported that he became aware of specific muscle groups that seemed to be more tense than others. This enabled him to consciously monitor and control tension levels. Another subject stated that the techniques used in the tapes could easily be transferred to other situations should he feel the need.

Flotation Rest Group.

All respondents from this condition felt relaxed and refreshed following a Flotation Rest session. However, there were two subjects who reported the experience to be somewhat strange at first, in that it took a few minutes to become accustomed to the environment. They reported that once they became accustomed to the tanks they drifted off into another thought state which was somehow different from dreaming, and that at the end of a float, they felt quite clear and focused.

Q 2; How did your muscles feel during the experience?

Progressive Muscle Relaxation Group.

All subjects mentioned that they felt relaxed after listening to the tapes. Three subjects reported that their muscles felt tense at first, but this feeling soon disappeared as they felt the tension drain away from their muscles. One subject mentioned that it took two or three sessions before he became aware of the tension draining from his muscles. An awareness of the ability to have control over one's physical feelings was mentioned by one subject as a benefit arising from listening to the tapes.

Flotation Rest Group.

Two subjects reported that their muscles felt tight or tense during the initial stages of the Flotation Rest session. One subject, elaborating on this remark, related these feelings of tightness to the positions in which he commenced the sessions. As he adjusted his body into a comfortable position he was able to relax. All subjects stated that their muscles felt invigorated after the session. However, the two subjects who cycled home after the session reported that their legs felt "dead" after a Flotation Rest session, and to this extent thought that it might not be effective to have a float immediately before an event. The benefits of the session were usually felt on the following day. As one subject stated "the muscles felt very good the day after a float".

Q 3; What were your initial expectations of the flotation tank/relaxation tapes?

Progressive Muscle Relaxation Group.

Three subjects stated that they had expected the tapes to relax them. Two subjects had expected that the tapes would lead to a greater state of awareness of muscle tension and provide some methods of controlling tension.

Flotation Rest Group.

Two subjects reported that their expectations were very similar to their experiences of the flotation tanks. One subject stated that he expected the experience to be similar to a hot bath after a long hard winter ride.

Q 4; Do you think that how you feel before competing affects the way you perform?

Progressive Muscle Relaxation Group.

All subjects, except one, answered Yes to this question.

Flotation Rest Group.

The response was Yes for all subjects. Only one subject felt that this was only the case in some circumstances.

Q 5. If so in what way?

Progressive Muscle Relaxation group.

Four subjects stated that negative feelings or thoughts prior to an event were detrimental to performance. These feelings hindered the acquisition of a steady rhythm, which in turn, affected performance. Positive feelings led to improved performance. One subject felt that being focused mentally and relaxed physically allowed him to put more energy into the sporting activity. This, he felt, translated to more successful performance, as less energy was wasted on unimportant things. One subject stated that he did not place too much pressure on himself to perform well, because he was more interested in having fun. He felt that his performance was linked to his energy reserves. One subject felt that being able to compete with a focused mind and a relaxed body allowed him to put more energy into the sporting activity.

Flotation Rest Group.

Subjects in this group also felt that being in a relaxed state of mind was important. Thinking about the wrong things was mentioned by one subject as being a factor that contributes to making mistakes. Another subject stated that confidence was a factor that contributed to performance, in that being confident allowed him to "handle the pain". The same subject commented that being less stressed was a "healthier" state which, in turn, allowed him to adopt the appropriate race tactics. The flotation tanks were seen by two subjects as being effective in enhancing their ability to focus, and as a means of motivating them to push past previous limits into across boundaries.

Discussion

This investigation was designed to compare the effects of Flotation Rest and Progressive Muscle Relaxation on a sample of competitive cyclists. The findings are discussed in the following order; blood pressure, heart-rate, POMS (McNair et al, 1971) total mood-scores and sub-scale scores, the SCAT (Martens, 1977) anxiety scores, and the Subjective Evaluations Questionnaire.

Blood Pressure

It was hypothesised that both systolic and diastolic blood pressure would be lower following Flotation Rest than following Progressive Muscle Relaxation. This explanation was based on the findings of Turner et al, (1989); Fine and Turner, (1982); Kristeller et al, (1982), and Jacobs et al (1984) who found reductions in blood pressure following Flotation Rest. This hypothesis is partially supported as diastolic blood pressure is significantly lower following Flotation Rest than it is following Progressive Muscle Relaxation. There were no significant differences between the two conditions for systolic blood pressure.

However, given the small sample in this study, an effect that approached significance should be considered to have some bearing on how the nature of the treatment effects are viewed. In the case of systolic blood pressure, the treatment condition by pre/post by time interaction could be considered to be approaching significance. If the sample were larger, then systolic blood pressure might have been significantly lower following Flotation Rest than following Progressive Muscle Relaxation treatments.

The finding that reductions on all of the physiological variables are obtained in both conditions from pre-test to post-test suggests that the treatments have similar effects in controlling these variables. However, the significant condition by pre/post treatment by time interaction for diastolic blood pressure indicates that Flotation Rest has a greater reducing effect than Progressive Muscle Relaxation

Among the studies that have examined the effects of Flotation Rest on blood pressure, direct comparisons are limited in power because of their small samples and subject characteristics. Kristeller, et al (1982) reported the effects of Flotation Rest on two subjects who were diagnosed as borderline hypertensives. Also Fine and Turner (1982) used a small number of essential hypertensives as subjects. Both studies are them unsuitable for comparison to the findings of the present study because of the small numbers of subjects and their high initial blood pressure readings..

In studies where the sample sizes and subject characteristics are more closely related to that of the present study the nature of the data presentation limits the comparisons that can be drawn. Turner et al (1987) found reductions in blood pressure following eight sessions of Flotation Rest with or without lighting. The systolic and diastolic blood pressure readings were not reported separately; instead they were presented as pooled data. Consequently, it can only be surmised that the treatments used in their study brought about parallel effects on both measures of blood pressure.

The current study found that the Progressive Muscle Relaxation treatment reduced diastolic blood pressure from pre-test to post-test readings. Jacobs et al (1984) found that their control group, which practised a relaxation program in a normal sensory environment, showed significant reductions only on diastolic blood pressure on the within-group comparisons of pre-test and post-test means. This finding for the control condition suggests that diastolic blood pressure is more amenable to a relaxation treatment manipulation than systolic blood pressure. Why similar reductions in systolic blood pressure following Progressive Muscle Relaxation did not occur in the current study is unclear. One possible explanation may be that types of relaxation programs used in the studies differed in some way. It may be that the relaxation program used in the present study facilitated systolic blood pressure reductions, while the program in the Jacobs study facilitated reductions in diastolic blood pressure.

Another reason the findings of the Jacobs et al (1984) study do not parallel those of the present study, with respect to reductions in diastolic blood pressure following a relaxation program, may be that the two studies differed in the type and/or number of subjects. In the Jacobs study, there were 28 volunteers used as subjects, who were selected on a first-come-first-served basis. In the present study all subjects are currently engaged in active competition as cyclists. Thus it would be expected that the subjects in the two studies differed with respect to fitness levels. There were only seven subjects undergoing the Flotation Rest treatment in the present study compared to 14 subjects assigned to the Flotation Rest treatment condition in the Jacobs study. This factor may contribute to a loss in the statistical power needed to obtain an effect. Had the sample in the present study been larger, the effect, while still the same size, might have been significant on the pre-test to post-test measures in diastolic blood pressure for the Progressive Muscle Relaxation condition.

The effects of Flotation Rest may be mediated by the number and spacing of sessions. In the Jacobs et al (1984) study there were 10 forty-five minute sessions in each condition at intervals of three to five days. Turner et al (1987) exposed their subjects to 8 treatment sessions, which were conducted on a bi-weekly basis. The close temporal proximity between treatment sessions in the Turner et al and Jacobs et al studies may be a mediating factor that lowers blood pressure. This may in part explain why there are no differences in systolic blood- pressure between the two conditions in the present study, while there were differences in systolic blood-pressure between the two conditions in the Jacobs et al study. In the present study the six experimental sessions were conducted on a weekly basis. It was not uncommon for subjects in the present study to miss a session, which meant that it was two weeks between sessions. Given this difference between the studies it could be speculated that the interval length between sessions and/or the number of sessions may influence the effectiveness of the treatment.

The reduction in systolic blood-pressure on the subjects in the present study following both Flotation Rest and Progressive Muscle Relaxation, suggests that both treatments are effective in controlling the pressor response of overtraining observed in cyclists (Hunter & McCarthy, 1983). This view needs to be tempered for two reasons. While some subjects did engage in high intensity training during the study, as indicated through verbal reports and the corresponding scores on the POMS (McNair et al, 1971) sub-scales for these subjects, the remaining subjects did not manipulate their training intensity.

Secondly, the lack of a control group in this study prevents the examination of the possibility that the effects obtained by the treatments are similar to those that would result from simply resting quietly for 45 minutes during the day, on a weekly basis. It remains to be seen whether the treatment effects observed in this study would occur on such a control group.

Heart Rate

Forgays et al (1991) found significant reductions in heart-rate following Flotation Rest. Based on their finding it was hypothesised that heart-rate would be lower following Flotation Rest than following Progressive Muscle Relaxation. This hypothesis is not supported as there are no significant differences in the reductions in heart rate between the two conditions.

On the basis of this finding it would seem that the treatments have similar effects on heart-rate. However, the variability in the data indicates that the reductions are not consistent. This is more critical in the case for the Flotation Rest condition, as there is a great deal of variability on the post-test measures for this group. The inconsistency of the reductions in heart-rate over the six treatment sessions suggests that even though the two treatments reduce heart-rate, the reductions, on any one occasion, may not be of a magnitude to justify the use of either treatment rather than a normal resting session of the same time span.

Heart-rate has been shown to be an indicator of over-training (Dressendorfer et al, 1985). What is required is a reliable treatment that will overcome the effects of over-training. The findings of this study, with regard to heart-rate, do not provide consistent evidence which would suggest that either treatment would reduce the increased heart-rate response associated with overtraining. The reasons for this view are not only the variability in the reductions found on the post-test measures, but also the absence of any reductions in the pre-test measures, which suggests a lack of persistence of any effect across the interval between-sessions.

Profile of Mood Scales Scores

Based on the findings of Turner et al, (1989) and Forgays and Forgays (1992) who found that Flotation Rest brought about changes in POMS scores, it was hypothesised that the cyclists in this study would display the iceberg POMS (McNair et al, 1970) profile following Flotation Rest. This hypothesis is not supported, as there are no differences between pre-test and post-test measures on the POMS sub-scales for the Flotation Rest condition. Both the pre-experiment and post-experiment profiles resemble the iceberg profile. However, they are not as distinctive as the iceberg profile (Morgan et al, 1987).

The absence of changes in mood-state variables, as measured by the POMS (McNair et al, 1971) suggest that the treatments used in this study did not affect the mood-states of the cyclists. The findings of this study, with regard to the POMS scores, stand in contrast to other studies that found significant reductions in POMS mood-scores following Flotation Rest (Turner et al, 1989; & Forgays & Forgays, 1992). Given the findings of these studies, the absence of POMS mood score changes in the present study may have been due to the nature of the experimental design. In the Turner et al study the POMS was administered before and after the first and last treatment sessions in order to assess the effect of mood across individual sessions. In the Forgays and Forgays study each subject underwent only two treatment sessions, with administration of the POMS before and after each session. The POMS has two versions; a "one-week" POMS and a "right-now" POMS. The one-week version asks subjects how they felt over the past week including the present moment. The right now POMS asks subjects how they felt over the last day. Neither the Turner et al nor the Forgays and Forgays papers, stated whether the POMS tests that were administered were the "one-week", or the "right-now" versions. It can only be assumed that the "right-now" POMS was administered, as they were testing before and after each treatment session. Thus, their findings represent the immediate effects of Flotation Rest. The present study administered the "one-week" POMS prior to the first test session and following the last test session. Thus, the findings of the present study extends the time span that is being measured by the test.

This distinction between the tests may explain why this study failed to show an affect on mood following Flotation Rest. It may be the case that Flotation Rest does bring about changes in the way subjects perceive their moods to have been over the previous day, as found by Turner et al (1989) and Forgays and Forgays (1992). But the Flotation Rest treatment may not change the way subjects perceive their mood over the last week, as indicated by the absence of any changes in mood following Flotation Rest in the present study. Taking into account the monotonic reductions found on the post-test blood pressure measures following Flotation Rest, it would be reasonable to expect a similar post-experimental treatment effect on the psychological measures. The absence of pre-experimental to post-experimental changes on any of the POMS scales, combined with the lack of pre-treatment effects on the physiological variables, suggests that neither treatment is effective in bringing about either psychological or physiological changes that extend beyond the immediate post-test period.

Another possible explanation of the lack of a mood effect may be that unless the training is increased to high intensity levels, the profiles of competitive cyclists may reflect a reasonably stable mood state which is fairly resistant to change.

Sports Competition Anxiety Test.

The fourth hypothesis, which predicted lower trait anxiety measures following Flotation Rest, is not supported. In contrast, the Progressive Muscle Relaxation group show significant reductions from pre-test to post-test measures on trait anxiety.

The Sports Competition Anxiety Test (SCAT) (Martens, 1977) was administered at the same sessions as the POMS (McNair et al, 1971). The finding of a significant reduction on trait anxiety for the Progressive Muscle Relaxation condition suggests that there may be some long term effects of this treatment. Given that trait anxiety is generally considered to be, and, indeed, is defined as being fairly stable, the finding of an effect on this measure with the small sample used in this study suggests that the Progressive Muscle Relaxation treatment is a fairly powerful technique for reducing anxiety. The implications of this finding is that Progressive Muscle Relaxation may be an effective method of reducing an athlete's susceptibility to injury. Nideffer (1981) proposed that the interactions of anxiety, performance demands and attention abilities contribute to the probability of injury. As the SCAT (Matrens, 1977) assesses competitive sports anxiety, reductions on this measure would tend to indicate that an athlete is less likely to be injured.

Subjective Evaluations Questionnaire.

The Subjective Evaluations Questionnaire provides a means of extending the findings of the empirical data. Given that the empirical data suggest that the changes occurring following the treatments do not extend beyond the post-test time frame, it is of relevance to note the responses of two subjects from the Flotation Rest group. Both subjects claimed that although they felt relaxed and refreshed following their sessions, during the course of their ride home their legs felt "dead". Because of this they felt that to undergo a Flotation Rest session immediately before an event would be ineffective.

The benefits of the flotation tanks may result from their ability to enhance an athlete's ability to focus on the task at hand. Studies that have shown improvements in athletic performance following Flotation Rest have used measures involving perceptual motor skills (Suedfeild et al, 1993) basketball (Suedfeild & Bruno, 1990; & Wagaman et al, 1991) and tennis (McAleney et al, 1990). In all of these studies Flotation Rest was combined with Imagery. Therefore, it may be that Flotation Rest facilitates the use of Imagery skills. This aspect of Flotation Rest has been an issue of some debate (Suedfeild, Ballard, Baker-Brown, & Borrie, (1985-86). Two subjects from the current Flotation Rest group stated that being in a relaxed state of mind was important with regard to race tactics, and that the flotation tanks were effective in enhancing their ability to focus and push past their previous limits. This indicates that should the flotation tanks have an effect on performance, these effects might be linked to the athlete's ability to apply themselves mentally to the task at hand. It should be borne in mind that these comments represent the views of only two subjects from the Flotation Rest group. Therefore only the most tentative of conclusions could be drawn from them.

External Validity

At issue in the present study is the extent to which any of the observed benefits of either of the two treatments can be transferred to the sports setting. As this study did not assess performance, there is no way to directly address this issue. What is required is an indication that the effects of either treatment generate changes over time on the pre-test measures, as this would indicate that the treatments contribute to an effect that extends beyond the time span of a single experimental session. Had there been a monotonic reduction across sessions in the pre-test measures on any of the variables that showed a treatment effect - namely, diastolic, and diastolic blood pressure, and heart-rate - then this would indicate that there are long term benefits to be gained by the treatments. The finding of a monotonic treatment effect on diastolic blood pressure following Flotation Rest indicates that there are increasing inter-session benefits of the treatment. What seems to be happening is that the floaters are getting better at benefiting from the treatment each time they use the flotation tanks. On each subsequent treatment session, the user gains more benefits, in terms of diastolic blood-pressure reductions, than they did on the prior session. In this sense the benefits are crossing the gap between sessions as the reductions in diastolic blood-pressure are greater in the later sessions than they are in the earlier ones. How long this monotonic effect will continue to occur is unknown at this stage of research into Flotation Rest.

The findings of this study indicate that should any performance benefits be derived from Flotation Rest, they may not extend beyond the time-span of a single experimental session. Some studies that have found performance benefits following Flotation Rest obtained their measures immediately following the test session. Suedfeild and Bruno (1990) found that basketball players exposed to one session of Flotation Rest plus Imagery had higher performance scores than a group who practised Imagery in an alpha chair and a control group who practised Imagery. Their measures were obtained immediately following the treatment session. Suedfeld et al (1993) exposed dartthrowers to one session of Flotation Rest only. The post-test measures were taken immediately following the Flotation Rest session. They found that their performance accuracy improved over their baseline measures which were taken immediately prior to the Flotation Rest session. Given these features of the two studies, and the findings of the present study, it may be that the performance enhancement properties of Flotation Rest are confined to the experimental session.

While this may be the case, there are two studies which assessed the effects of Flotation Rest on actual competition performance and found Flotation Rest to be effective. Barabasz and Barabasz (1991) found improvements in collegiate basketball following six sessions of Flotation Rest. McAleney et al (1990) found improvements in intercollegiate tennis performance following six sessions of Flotation Rest. The findings of these two studies suggest that the performance enhancement effects of Flotation Rest extend beyond the experimental session. However, if we take into account that the two studies combined Flotation Rest with Imagery, then there exists the possibility that Flotation Rest facilitated performance by enhancing the Imagery process, and not through producing changes which would be effective in situations which did not involve Imagery.

On the basis of the measures used in this study it appears the only expected outcome beyond the immediate post-test period would be a reduction in sports-specific trait anxiety following six sessions of Progressive Muscle Relaxation. Even this conclusion needs to be tempered as there were no pre-test measures obtained on this variable which might have indicated any carry-over effects from the treatment. The results might simply be due to other factors apart from the treatment. This may have been the case given the time lag between tests on this measure, however the consistent findings on all of the POMS (McNair et al, 1971) sub-scales suggests that factors apart from the treatments may not have influenced the results. Therefore, the findings with regard to the SCAT scores need to be viewed with caution, as they are inconsistent with the POMS sub-scale scores. On the other hand, it needs to be borne in mind that the tests measure different things. On this basis then Progressive Muscle Relaxation could be considered to reduce sports-specific anxiety.

Limitations

In this study it was not possible to obtain performance measures, and the subjects were not exposed to increased training levels. Had both of these features been implemented, then the findings could have been directly related to the sports setting, providing ecological validity for the study. The absence of a control group prevented a comparison of the treatment effects to a those of a normal resting period. Also, a larger sample would have increased the statistical power of the study.

Conclusions

The findings of this study contribute to the research into Flotation Rest in that it detected monotonic within treatment effects due to Flotation Rest on post-test blood-pressure readings.

Both treatments lower systolic and diastolic blood pressure from pre-test to post-test measures. The monotonic reductions found on the post-test measures of systolic blood pressure following Flotation Rest and Progressive Muscle Relaxation suggest that repeated exposure to the treatments results in the user becoming better at using the treatment at each subsequent session. The monotonic reduction on diastolic blood pressure following Flotation Rest suggests that similar within sessions treatment effects are occurring, and that these effects are becoming greater at each subsequent session The absence of any monotonic reductions on the pre-test measures for these variables suggests that if there were any carry-over effects of the treatments they did not appear on the pre-test readings.

The post-test readings for heart-rate were lower than the pre-test readings for both treatments. The two treatments have similar effects on heart-rate. The lower heart rates obtained on the post-test measures suggest that the treatments may be effective in overcoming some of the effects of overtraining. However, the variability in the reductions suggests that the benefits of the treatments may not be of a desired magnitude on any one occasion.

There were no changes on the POMS (McNair et al, 1971) total mood scores or on the POMS sub-scales from pre-test to post-test for both conditions. Neither treatment appears to be effective in altering the mood states of cyclists undergoing normal levels of training.

The lower trait anxiety measures obtained following Progressive Muscle Relaxation imply that the treatment is effective in lowering the anxiety levels of competitive cyclists. However, there exists the possibility that other factors might have influenced these measures.

Suggestions for Future Research

In light of the findings of the present study which shows that the two treatments have similar effects in reducing systolic blood pressure and heart rate, and the similar findings on the POMS (McNair et al, 1971) scales, it appears that research should be directed towards comparing the two treatments. Apart from the Kaplan and Babarasz (1988) and the present study little research has been directed along these lines.

This study detected monotonic reductions on the post-test readings of blood pressure following Flotation Rest. These reductions increased on each subsequent treatment session. This raises two questions; if the session intervals were closer, would this effect be greater? Is there an optimal number of treatment sessions before which this effect begins to plateau?

References

Alport, R., Haber, R. N. (1960). Anxiety in academic achievement situations. *Journal of Abnormal and Social Psychology, 21*, 207-215.

Anderson, M. B., & Williams, J. M. (1988). A model of stress and athletic injury. *Journal of Sport and Exercise Psychology, 10,* 398-406.

Australian Cycling Federation. Coaching Manual Level - Two. Australian Coaching Council.

Barabasz, A F., Barabasz, M. (1991). Flotation rest and imagery in the improvement of collegiate basketball performance. *Perceptual and Motor Skills, 72,* 119-122.

Benson, H., Frankel, F. H., Apfel, R., Daniels, M. D., Schniewind, H. E., Nemiah, J. C., Sifneos, P. E., Crassweller, K. D., Greenwood, M. M., Kotch, J. B., Arms, P. A., & Rosner, B. (1978). Treatment of anxiety: A comparison of the usefulness of self- hypnosis and a meditational relaxation technique - an overview. *Psychotherapy and Psychosomatics,6,* 87-98.

Beuter, A., Duda, J. L. (1985). Analysis of the arousal/motor performance relationship in children using movement kinematics. *Journal of Sport Psychology, 7,* 229-243.

Bohlmann, J. T. (1981). Injuries in competive cycling. *The Physician and Sportsmedicine*, 9, 117-124.

Bond, J. (1986). Sports hypnosis at the A.I.S. *Excel, 2, (4),* 9-11.

Bramwell, S. T., Masuda, M., Wagner, N. N., & Holmes, T. H. (1975). Psychological factors in athletic injuries: Development and application of the Social and Athletic Readjustment Rating Scale.(SARRS). *Journal of Human Stress, 1, (2)* 6-20.

Chogovadze, A. V., & Butchenko, L.A. (1992). Overtraining. *Fitness and Sports Review International. Incorporating the Soviet Sports Review, 27*(4), 19-21.

Cryan, P. D., & Alles, W. F. (1983). The relationship between stress and college football injuries. *Journal of Sports Medicine, 23,* 52-58.

Cummings, M. S., Wilson, V. E., Bird, E. I. (1984). Flexibilty development in sprinters using EMG biofeedback and relaxation training. *Biofeedback and Self-Regulation, 9, (3),* 395-405.

Deabler, H. L., Fidel, E., Dillenkoffer, R. L., & Elder, S. (1973). The use of relaxation and hypnosis in lowering high blood pressure. *American Journal of Clinical Hypnosis, 16,* 75-83.

Dressendorfer, R. H., Wade, C. E., & Scaff, J. H., (1985). Increased morning heart rate in runners: A valid sign of overtraining?.*The Physcian and Sportsmedicine, 13, (8),* 77-86.

Easterbrook, J.A. (1959). The effect of emotion on cue utilization and the organization of behaviour. *Psychological Review, 66,* 183-201.

Feltz, D. L., & Landers, D. M. (1983). The effects of mental practice on motor skill learning and performance: A meta-analysis. *Journal of Sport Psychology, 5,* 25-57.

Fine , T. H., & Turner, J. W. Jr. (1982). The effect of brief restricted environmental stimulation therapy in the treatment of essential hypertension. *Behaviour Research and Therapy, 20,* 567-570.

Fisher, A. G. (1976). Psych up, psych down, psych out: relationship of arousal to sport performance. In Fisher.(Ed.).*Psychology of sport: issues and insights.* Palo Alto California. Mayfeild Pub Co.

Forgays, D. G., & Forgays, D. K. (1992). Creativity enhancement through flotation isolation. *Journal of Environmental Psychology, 12,* 329-335.

Forgays, D. G., Forgays, D. K., Pudvah, M., & Wright, D. (1991). A direct comparison of the "wet" and "dry" flotation environments. *Journal of Exercise Psychology, 11,* 179-187.

Forgays, D. G., McLure, G. N. (1974). A direct comparison of the effects of the quiet room and water immersion isolation techniques. *Psychophysiology, 11,* 346-349

French, S. N. (1978). Electromyographic biofeedback for tension control during gross motor skill acquisition. *Perceptual and Motor Skills, 47,* 883-889.

Frumjin, K., Natham, R. J., Prout, M. F., Cohen, M, C. (1978). Nonpharmacological control of essential hypertension in man: A critical review of the experimental literature. *Psychosomatic Medicine, 40, 4,* 294-320.

Griffiths, T. J., Steel, D. H., Vaccaro, P., & Karpman, M. B. (1981). The effects of relaxation techniques on anxiety and underwater performance. *International Journal of Sport Psychology*, 12, 176-182.

Hagberg. J. M., Mullin. J.P., Bahrke. M. & Limburg. J. (1979). Physiological profiles and selected psychological characteristics of national class American cyclists. *Journal of Sports Medicine, 19,* 341-345.

Hardy, L. (1992). Psychological stress, performance, and injury in sport. *British Medical Bulletin, 48,* 615-629.

Hull, C. L. (1943). *Principles of behavior*. New York: D. Appleton.

Hunter. G. R., & McCarthy. J. P. (1983). Pressor response associated with high-intensity anaerobic training. *The Physcian and Sportsmedicine, 11 (4)*, 151-162.

Hutchison, M. (1984). *The book of floating: exploring the private sea.* New York: Morrow.

Jacobs, A. A. (1988). Sport psychology and its relationship to cycling. In E., R. Burke & M., M. Newsom (Eds.) , *Medical and scientific aspests of cycling*. (pp. 199-208). Illinois: Human Kinetics Books.

Jacobs, G. D., Heilbronner, R, L., & Stanley, J, M. (1984). The effects of short term flotation rest on relaxation: A controlled study. *Health Psychology, 3 (2),* 99-112.

Jacobson, E. (1938). *Progressive relaxtion.* Chicago, IL: University of Chicago.

Janssen. P. G. J. M. (1987). *Training lactate pulse rate.*Finland: Polar Electro Co.

Jeukendrup, A. E., Hesselink. M. K. C., Synder, A. C., Kuipers, H., & Keizer, H. A. (1992). Physiological changes in male competitive cyclists after two weeks of intensified training. *International Journal of Sports Medicine,13,* 534-541.

Johnson, W. R. (1976). Hypnosis and muscular performance. In A. C. Fisher (Ed.), *Psychology of sport* Palo Alto, CA: Mayfeild..

Kaplan, G. M., Barabasz, A, F. (1988). Enhancing hypnotizability: Differential effects of flotation restricted enviromental stimulation technique and progressive muscle relaxation. *Australian Journal of Clinical and Experimental Hypnosis, 16 (1),* 39-51.

Klavora, P. (1979). Customery arousal for peak athletic performance. In P. Klavora & J. V. Daniel (Eds.), *Coach, athlete, and the sport psychologist.* Champaign, IL: Human Kinetics Publishers.

Kleine, D. (1990). Anxiety and sport performance: A meta-analysis. *Anxiety Research, 2,* 113-131.

Kleine, D., Sampedro, R.M., & Melo, S. L. (1988). Anxiety and performance in runners: Effects of stress and anxiety on physical performance. *Anxiety Research, 1,* 235-246.

Krakauer, J. (1986). Flotation tanks. *Ultrasport, 9,* 13-15.

Kristeller, J. L., Schwartz, G. E., Black, H. (1982). The use of restricted enviromental stimulation therapy (rest) in the treatment of essential hypertension: Two case studies.*Behaviuor Research and Therapy, 20,* 561-566.

Landers, D. M. (1980). The arousal-performance relationship revisited. *Research Quartly for Exercise and Sport, 51,* 77-90.

Lanning, W., Hisanaga, B. (1983). A study of the relation between the reduction of competition anxiety and an increase in athletic performance. *International Journal of Sports Psychology, 14,* 219-227.

Lee, A. B., & Hewitt, L. J. (1987). Using visual imagery in a flotation tank to improve gymnastic performance and reduce physical symptoms. *International Journal of Sport Psychology, 18,* 223-230.

Malmo, R. B. (1959). Activation: A neuropsychological dimension. *Psychological Review, 66,* 367-386.References

Martens, R. (1971). Anxiety and motor behaviour: A review. *Journal of Motor Behaviour, 3,* 151-179.

Martens, R. (1977). *Sport Competition Anxiety Test.* Champaign, IL: Human Kinetics

Martens, R., & Landers, D. M.(1970). Motor performance under stress: A test of the inverted-U hypothesis. *Journal of Personality and Social Psychology, 16,* 29-37.

Matheny. F. (1986). *Solo Cycling: How to Train and Race Time Trials.* Vermont: Velo-News.

McAleney, P. J., Barabasz, A., Barabasz, M. (1990). Effects of restricted environmental stimulation on intercollegiate tennis performance. *Perceptual and Motor Skills, 71,* 1023-1028.

McNair, D. M., Lorr, M. & Droppleman, L. F. (1971). Profile of Mood States Manuel. Educational and Industrial Testing Service, San Diego.

Moll, A. (1958). *A study of hypnosis: Historical, clinical, and , experimental research in the technique of hypnotic induction.* New York: Jilian Press. (Original work published 1889).

Morgan, W. P., & Brown. D. R. (1983). Hypnosis. In M. E. Williams (Ed .), *Ergonomic aids and sports.* Champaign, IL: Human Kinetics.

Morgan, W. P., Facsm. D. R., Brown. D. R., Raglin. J. S., O'Connor. P. J., & Ellickson. K.A. (1987). Psychological monitoring of overtrainig and staleness. *British Journal of Sports Medicine, 27,* 107-114.

Morgan, W. P. (1985). "Selected psychological factors limiting performance: A mental health model". In Limits of Human Performance. D. H. Clarke and H. M. Eckert (Eds), Human Kinetics Publishers, Champion IL.

Naatanen, R. (1973). The inverted-U relationship between activation and performance: A critical review. In S Kornblum (Ed.), *Attention and performance IV*. New York: Academic Press.

Neiss, R. (1988). Reconceptualising arousal: Psychobiological states in motor performance. *Psychological Bulletin, 103*, 345-366.

Nideffer, R., M. (1976). *The inner athlete: Mind plus muscle for winning*. New York: Thomas Crowe

Nideffer, R., M. (1981). *The ethics and practice of applied sport psychology*. Ithaca, NY: Mouvement.

Ogilvie, B. C. (1979). Critical issues in the application of clinical psychology in the sport setting. *International Journal of Sport Psychology, 10,* 178-183.

Onestak, D. M. (1991). The effects of progressive relaxation, mental practice, and hypnosis on athletic performance: A review. *Journal of Sport Behaviour, 14, (4),* 247-282.

Oxendine, J. B. (1970). Emotional arousal and motor performance. *Quest, 13,* 23-32.

Pressman, M. R. (1979). Psychological techniques for the advancement of sport potential. In P. Klavora & J. V. Daniel (Eds.), *Coach, athlete,and the sport psychologist*. Champaign, IL: Human Kinetics.

Pyke, F. S., Craig, N. P., & Norton, K. I. (1988). Physiological and psychological responses of pursiut and sprint track cyclists to a period of reduced training. In Burke, E. R., & Newsom, M. M (Eds), *Medical and Scientific Aspects of Cycling. (pp.147-163)* . America: Human Kinetics Publishers, Inc.

Ravizza, K. (1977). Peak experiences in sport. *Journal of Humanistic Psychology, 17,* 35-40.

Ryde, D. (1964). A personal study of some uses of hypnosis in sport and sport injuries. *Journal of Sports Medicine and Physical Fitness, 4,* 241-246.

Schnore, M. M. (1959). Individual patterns of physiological activity as a function of task differences and degree of arousal. *Journal of Experimental Psychology, 58,* 117-128.

Sonstroem, R. J., & Bernardo, P. (1982). Individual pregame state anxiety and basketball performance: A re-examination of the inverted-U curve. *Journal of Sport Psychology, 4,* 235-245.

Spence, J. T., & Spence, K. W. (1966). In C. D. Spielberger (Ed.), *Anxiety and Behavior*. Academic Press, New York.

Spence, K. W. (1951). Theoretical interpretations of learning. In S. S. Stevens (Ed.), *Handbook of experimental psychology*. New York: Wiley.

Suedfeild, P., Ballard, E.J., Baker-Brown, G., & Borrie., R.A. (1985-86). Flow of conscious-ness in restricted enviromental stimulation. *Imagination, Cognition and Personality, 5,* 219-230.

Suedfeild, P., Bruno, T. (1990). Flotation rest and imagery in the improvement of athletic performance. *Journal of Sport and Exercise Psychology, 12,* 82-85.

Suedfeild, P., Collier, D. E., Hartnett, B. D. G. (1993). Enhancing perceptual-motor accuracy through flotation rest. *The Sport Psychologist, 7,* 151-159.

Suinn, R. M. (1985). The 1984 Olympics and sport psychology. *Journal of Sport Psychology, 7,* 321-329.

Turner, J. W. Jr., Fine, T., Ewy, G., Sershon, P., Freundlich, T. (1989). The presence or absence of light during flotation restricted enviromental stimulation: Effects on plasma cortisol, blood pressure, and mood. *Biofeedback and Self Regulation, 14 (4),* 271-300.

Unestahl, Lars-Eric. (1986). Self-Hypnosis. In J. M. Williams (Ed.). *Applied Sport Psychology: Personal Growth to Peak Performance.* (pp. 285-300). Mountain View: Mayfield Publishing Co.

Verde, T., Thomas, S., & Shepard, R. J. (1992). Potential markers of heavy training in highly trained distance runners. *British Journal of Sports Medicine, 26, (3),* 167-175.

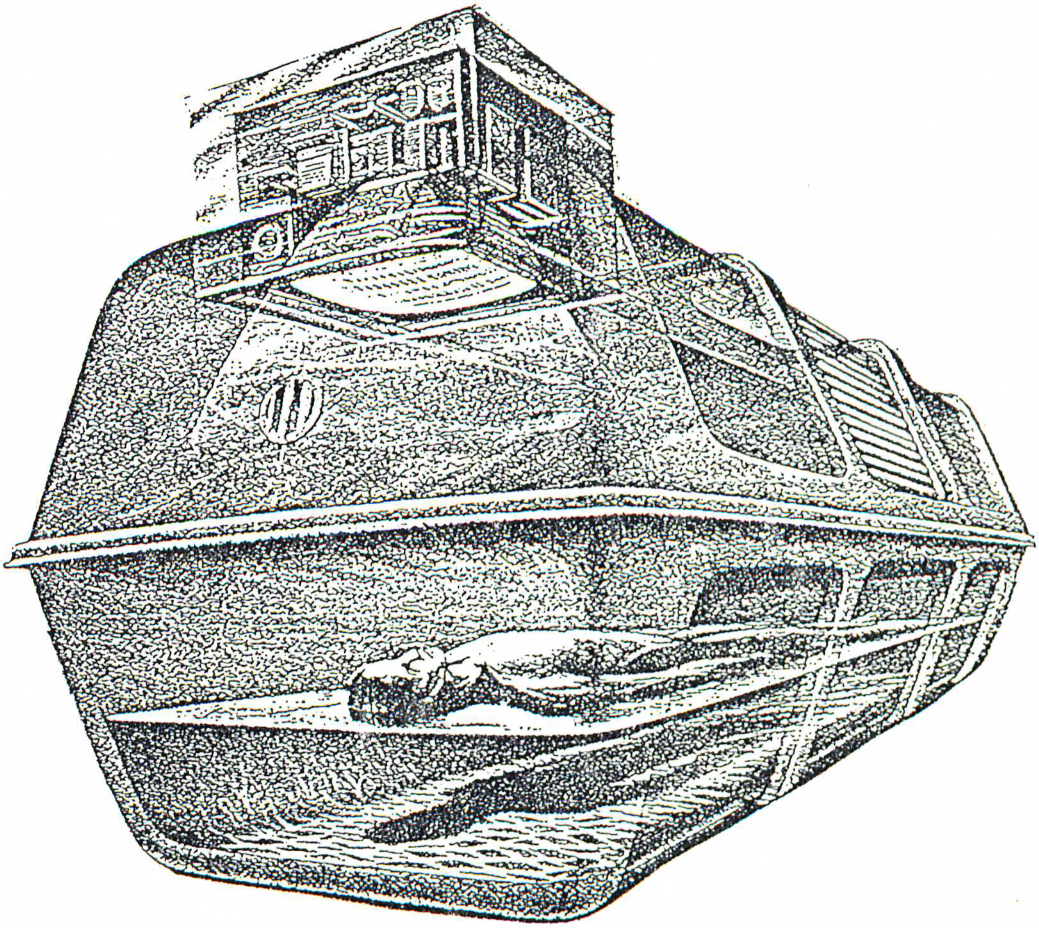
Weinberg, R. S. (1990). Anxiety and motor performance: Where to from here? *Anxiety Research, 2,* 227-242.

Wojcikiewicz, A., & Orlick, T. (1987). The effects of post-hypnotic suggestion and relaxation with suggestion on competitive fencing anxiety and performance. *International Journal of Sport Psychology,3,* 135-138.

Yerkes, R. M., & Dodson, J. D. (1908). The relation of strenght of stimulus to rapidity of habit formation. *Journal of Comparitive Neurology and Psychology, 18,* 459-482.

Appendices

Appendix A



Cross sectional view of a flotation tank.

EXCEL Vol. 4 No. 1 September 1987

Appendix B

Data List

03 1 113 66 73 113 61 83 121 73 81 113 69 69 124 79 57 115 70 73 126 82 53
110 64 68 106 62 48 117 69 81 122 72 56 125 75 78 114 62 69 38 40 42 40 58 44 262 42 46 39 33 60 46
266 499 296 17
04 1 145 73 80 133 64 65 131 63 54 132 61 76 128 62 57 138 57 75 126 67 57
121 66 74 119 42 63 120 66 65 120 55 65 135 69 74 097 44 66 52 45 52 55 45 39 178 49 47 62 37 63 66
250 398 499 16
06 1 116 70 65 116 71 65 116 70 64 113 68 53 118 77 54 117 71 53 107 62 53
121 76 61 117 59 54 113 64 66 124 69 65 115 64 61 114 60 56 41 42 53 57 35 39 153 40 41 39 62 37 39
134 377 441 22
07 1 140 95 53 130 86 58 130 85 55 145 98 58 121 77 48 140 86 57 120 72 54
141 89 58 125 73 52 145 99 63 127 79 63 144 98 54 127 80 52 40 42 40 63 37 37 133 37 38 52 73 34 32
120 591 634 45
08 1 117 76 59 123 74 67 114 76 63 117 77 69 116 60 69 125 82 63 111 64 58
113 71 68 116 63 62 115 74 59 107 64 65 108 73 63 110 73 66 42 38 39 57 61 32 155 45 39 40 62 57 35
154 634 698 36
09 1 101 63 48 099 60 55 097 62 52 100 63 51 088 51 50 106 68 42 097 53 39
102 61 68 096 54 57 106 66 54 094 50 48 100 64 58 086 47 42 33 37 42 66 41 35 122 31 37 37 70 35 33
103 612 399 54
19 1 133 75 72 120 75 60 123 63 57 124 74 67 108 59 65 138 79 76 112 65 68
140 81 57 121 80 50 140 91 67 116 78 75 120 79 64 102 50 54 42 53 61 38 61 52 307 55 50 57 37 57 53
309 655 655 22
01 2 105 59 46 111 60 59 106 61 49 110 56 48 105 59 47 106 54 51 104 57 46
114 61 57 110 64 43 124 70 58 112 61 51 106 61 44 107 63 44 41 37 37 48 38 32 137 38 37 40 57 43 32
133 423 347 16
02 2 113 59 43 110 60 44 107 63 44 117 63 69 112 64 56 110 67 73 110 58 54
115 60 65 120 65 59 114 72 66 117 71 53 112 58 53 112 64 42 35 46 44 40 49 46 180 40 44 40 40 41 33
158 499 322 16
13 2 124 72 47 122 59 49 121 65 44 124 67 43 118 64 42 128 64 57 124 66 51
114 67 41 111 63 45 129 65 54 128 75 58 129 75 43 118 69 42 43 41 44 71 43 43 285 38 41 37 71 40 41
268 527 484 25
14 2 129 91 85 122 88 91 126 81 87 135 90 70 131 91 71 143 99 74 131 89 77
142 99 75 138 98 71 140 99 67 143 96 67 129 92 90 116 77 87 34 40 49 63 41 33 134 35 39 54 37 48 33
172 484 356 57
16 2 148 99 53 141 90 64 128 87 61 145 97 47 139 92 50 132 92 65 124 83 64
138 88 66 135 87 58 133 82 55 132 88 59 135 84 56 124 79 49 47 40 49 49 49 32 168 38 38 45 63 38 32
128 548 505 39
17 2 117 70 54 124 75 53 109 69 46 130 84 63 110 72 59 124 75 68 117 75 56
122 75 58 116 76 56 119 75 55 109 66 54 119 69 54 112 73 58 45 42 44 57 46 43 277 47 39 42 55 43 41
267 441 441 26
18 2 111 68 68 124 82 59 125 85 53 122 76 69 123 79 61 124 80 64 126 78 70
144 95 67 131 89 59 134 94 70 129 88 63 127 79 83 119 81 68 42 38 40 38 48 35 241 40 40 42 49 43 35
249 634 570 36
20 2 137 83 51 140 83 65 141 86 51 111 77 70 107 72 63 117 76 58 117 78 54
115 73 70 104 65 59 127 75 64 120 78 58 123 83 52 116 78 49 41 38 42 55 34 37 137 51 40 56 60 34 32
153 420 292 54

RELAXATION EXPERIMENT
INFORMATION SHEET

Purpose of experiment

The purpose of this study is to assess the effects of various relaxation treatment programs on measures of blood pressure, heart rate, and the individual's own feelings.

What is required of you as a subject

Time; each experimental session will be of approximately 1 1/4 hours, including measurement procedures. Only the first and last trials, requiring the completion of the questionnaire will be longer. These sessions should take approximately half an hour extra.

Venue for the experiment; you will need to make your own arrangements to be at the S.A. Institute of Sport, 27 Valletta Rd Kidman Park for each experimental sessions at the arranged times.

Your role in the experiment depends on which experimental condition you are allocated to. If it is the flotation tank condition, you will be required to lie naked in a flotation tank which contains a concentrated Epsom salts solution, heated to a temperature of 94± 0.5 F. The tank will be closed so as to eliminate any light. Each session in the tank will be of no more than 45 minutes. The flotation tank is constantly supplied with fresh air. If you are allocated to the progressive relaxation condition, you will required to lie on the floor, in a dimly lit room progressively contracting and relaxing designated muscle groups. Again this will take no longer than 45 minutes.

The experiment will be run over a period of approximately 6 weeks. You will be required to attend 1 session per week. At this stage it is expected that testing will be conducted on Monday and Friday afternoons ,and possibly evenings. In addition there will be 2 familiarisation sessions, so that you can become comfortable in the floatation tanks. For those volunteers who do not get placed in the floatation tank group, at the end of the testing period they will have the option of up to 4 free sessions in the floatation tanks. If you are interested in participating could you please indicate on the sheet provided what times you may be available.

Method to be used in the experiment

Blood pressure and heart rate will be measured before and after each trial in both the flotation tank and progressive relaxation sessions. Questionnaires will be administered prior to the first trial and following the last trial. There may also be a performance measure included in the experiment . At this stage it is not clear what form this could take.

Perceived Risks to the subject

In general it is expected that you should experience no discomfort whatsoever. However, only a small proportion of people experience sensations of claustrophobia in flotation tanks. Should this happen to you, you have only to reach up and open the tank. There is absolutely no obligation to continue if you don't want to , for this or for any other reason.

Contact telephone numbers

Should you feel the need to contact me or any of the persons associated with the experiment at any time, we can be reached at the following numbers;

Peter Stanislawski	Unit 4 274 Ward st North Adelaide 5006. AH 267-1194 B H 228-5693
Dr Peter Delin	B H 228-5693
Graham Winter	B H 416-6677
Cathy Martin	B H 416-6677

Volunteering procedure

If you feel that you would like to take part in the experiment, you should bring the attached form with you to the races next week. Alternatively, you can post it to me at the North Adelaide address shown above. I am hoping to commence testing in approximately 2 weeks so I would need to have an indication of your participation as soon as possible so as to be able to arrange session times. If you have any queries regarding the experiment please feel free to contact me on the above number. Most evenings are the best times to catch me.

RELAXATION EXPERIMENT

Name------------------------------------
Address---

Phone No--A.H--
B.H---
Sex---------
Age---------
Grade you usually race in-------------
No of kilometres ridden per week on average--------------
Times available for testing; ---------------------------------
----

Appendix D

UNIVERSITY OF ADELAIDE

DEPARTMENT OF PSYCHOLOGY

CONSENT FORM

(To be used to obtain informed consent of persons participating in research projects under the aegis of the Department of Psychology)

Participant's Name (capitals): ....

Project title: ....

Name of responsible investigator or supervisor: ....

Name of person who issues the form: ....

1. I consent to participate in the above project. The nature of the project, including questionnaires or procedures, has been explained to me, and is summarised on an information sheet I have been given.

2. I authorize the responsible investigator or the person named above to use these questionnaires or procedures with me.

3. I understand that:

   (a) I am free to withdraw from the project at any time.

   (b) The project is for the purpose of research or teaching, and not for treatment.

   (c) The confidentiality of the information I provide will be safeguarded.

   (d) There are no known adverse effects of questionnaires or procedures.

Signed: .... Date: ....
(Participant)

Where the participant is not a student of the University and is under 18 years of age, the following section should be completed.

I consent to the participation of .... in the above project.

Signed: .... Date: ....
(parent/guardian/in loco parentis)

Note: This form may be copied, or altered to fit the project. It is designed for use only when there are no known adverse effects of the questionnaires or procedures.