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THE EFFECT OF A SIX-MONTH PSYCHO-, PHYSIOLOGICAL, FINANCIAL AND STRESS MANAGEMENT EXERCISE PROGRAMME ON SOUTH AFRICAN CORRECTIONAL SERVICES PERSONNEL

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ABSTRACT

A six month study was undertaken to compare the implications of a stress management exercise programme on psychophysiological parameters, psychological stress levels, medical care costs and work absenteeism on 131 members of the South African Correctional Services Department who volunteered for the study. Group A (n=71) followed an individualized cardiovascular and circuit training programme for 50 minutes duration, 3x/week and one psychological progressive muscular relaxation session per week. Group B (n=8) only received one psychological progressive muscular relaxation session per week. The Control group (n=52) continued with their daily activities. Group A showed significant favourable changes in body mass, percentage body fat, bent knee sit-ups, trunk flexibility, physical work capacity, resting diastolic and systolic blood pressure, TC and LDL-C and uric acid levels, as well as reduced psychological stress levels, medical care costs (54.73%) and absenteeism (54.24%). Group B had a significant reduction in trunk flexibility, physical work capacity, total sources and total symptoms of stress and an increase in LDL-C. The Control group showed significant increases in body mass, percentage body fat, systolic blood pressure, TC, fasting glucose levels, total sources of stress and absenteeism with significant decreases in physical work capacity and vulnerability to stress. Results suggest that a stress management exercise programme on South African Correctional Services personnel can make a valuable contribution to the reduction of psychological stress levels, medical care costs, work abseneeism and improvement of the health profile of the South African Correctional Services member.

Key words: Physiological, psychological, financial implications, stress management, exercise programme, correctional services personnel.

INTRODUCTION

Human energy expenditure requirements have declined during the twentieth century, due to the fact that many individuals are no longer exposed to such strenuous or vigorous tasks, such as manual labour (Park, 1989). This has resulted in the development of the so called hypokinetic diseases (Kraus & Raab, 1961; Blair, Kohl, Gordon & Paffenberger, 1992). Diseases which are associated with a sedentary lifestyle are coronary heart disease, hypertension, low back pain, and diabetes mellitus (Blair, Oiserchia, Wilbur & Crowder, 1986). Contrary of what can be expected to living in greater comfort stress levels were not reduced (Sutherland & Cooper, 1990). Long-term exposure to stress has been associated with certain of the hypokinetic diseases listed above, namely: lumbago (Hinkle, 1987); coronary heart disease (Theorell, 1986); hypertension (Theorell, 1986); diabetes mellitus (Shillitoe, 1988); ulcers (Gilligan, Fung, Piper & Tennant, 1987); asthma (Irwin & Anisman, 1984); mental ill-health (Miner & Brewer, 1976) and atherosclerosis (Ivancevich & Matteson, 1988). Correctional Services personnel have been found to have a higher incidence of coronary heart disease (Harenstam, Palm &

Theorell, 1988; Theorell, 1986); hypertension (Kiely & Hodgson, 1990); ulcers (Kieley & Hodgson, 1990); and atherosclerosis (Cheek & Miller, 1983) than the general population.

Research has indicated that exercise is as effective as other stress management techniques to reduce stress levels (Berger, 1994). Kiely and Hodgson (1990) tentatively conclude that physical exercise programmes for correctional services members increase their resistance to stress due to greater physical fitness. This opinion is shared by Cheek and Miller (1983), Cooper (1985), Grossi and Berg (1993) and Kiely and Hodgson (1990). There has been little to provide objective data on the 'bottom-line' monetary benefits and the decrease in work absenteeism that may result from and exercise programme (Browne, Russel, Morgan, Scott, Optenberg & Clarke, 1984).Considering that the above mentioned illnesses resulted in a salary loss of R2 984 409-00 for the South African Correctional Services over a 10 month period, a solution needs to be found.

The purpose of this study is to compare the implications of a six month stress management exercise programme on medical care costs, work absenteeism, psychological stress levels and physiological parameters on Correctional Services personnel, rated the third highest of all occupational stress groups. It is hypothesised that if a stress management exercise programme is followed on a regular basis by Correctional Services personnel a reduction in their medical care costs, work absenteeism and psychological stress levels may occur. This could result in a favourable change in certain psycho-physiological parameters. Such evidence is needed before the Department of Correctional Services and other corporations make commitments for fitness equipment and personnel.

METHODS AND PROCEDURES

Subjects

One hundred and sixty (160) Correctional Services members volunteered for the study from four command areas, namely: Headquarters, Kroonstad, Pretoria and Zonderwater with 131 subjects completing the study. Each command area had an experimental group and a control group. For analysis purposes the experimental groups from the four command areas were combined to form Group A (n = 71), whilst all four

control groups from each command area were grouped to form the Control group (n = 52). The experimental group participated in an exercise and stress management programme, while the control group received no intervention at all. An additional 8 volunteers from Headquarters were grouped to form Group B who received only one psychological progressive relaxation session per week with no exercise intervention. Table 1 presents the gender and age distribution of the three groups. Each subject completed and signed an indemnity and informed consent form prior to participating in the study.

Study design

An experimental pretest-posttest randomized group design was used in the study.

Physical evaluation: All subjects completed a health history profile questionnaire which was used to gain the subjects personal details; determine any contra-indications to exercise testing (e.g. musculoskeletal injury) and lifestyle habits. This was followed by a physiological evaluation which consisted of anthropometric measurements, namely: stature and body mass (Smit, 1979); body composition (Drinkwater & Ross, 1980); trunk flexibility using the sit and reach test; physical work capacity (PWC 170) (American College of Sport Medicine, 1991) and abdominal strength using the bent knee sit-up test (Kirkendall, Gruber & Johnson, 1980). A biochemical analysis was done on serum in order to determine total cholesterol (TC); low density lipoprotein cholesterol (LDL-C); high density lipoprotein cholesterol (HDL-C); triglyceride (TG); fasting glucose and uric acid levels.

Psychological evaluation: Each subject completed a Stress Audit questionnaire (Miller & Smith, 1983). This questionnaire determined each subject's sources of stress, symptoms to stress and vulnerability to stress. The questionnaire was completed under the supervision of a registered clinical psychologist who was also responsible for the weekly progressive muscular relaxation session for Groups A and B (see results).

Intervention: Group A followed the prescribed exercise programme consisting of: a warm-up (7 min) of light stationary cycling; 20 min. of stationary cycling at 70% of maximum heart rate; 15 min. circuit training ending with 5 min. of stretching. This

Table 1: Gender and age distribution within each group.

GROUP	TOTAL (n)	AGE (YRS)		MALE		FEMALE	
		$\bar{X}$	SD	n	%	n	%
GROUP A	71	38.79	8.00	56	78.87	15	21.13
GROUP B	8	38.38	8.80	6	75.00	2	25.00
CONTROL	52	36.96	7.27	39	75.00	13	25.00

Table 2: Changes in the physiological characteristics of the subjects.

			PARAMETERS						
GROUP			BODY MASS	% BF	SIT-UPS	FLEXIBILITY	PWX 170	SBP	DBP
A	T1	X	89.55	19.94	28.34	38.96	15.70	134.45	90.00
		SD	18.69	6.70	8.28	9.10	6.06	14.05	9.74
	T2	X	87.83	17.41	35.22	42.53	21.65	129.55	85.00
		SD	18.11	6.05	8.76	8.87	5.49	11.54	8.33
%♦			1.92↓*	12.69↓*	23.92↑*	9.162↑*	37.89↑*	3.64↑*	5.56↓*
B	T1	X	85.60	18.74	---	40.64	17.85	127.25	88.00
		SD	24.12	5.33	---	6.50	4.86	15.30	14.58
	T2	X	85.78	18.70	---	39.74	16.55	126.75	88.75
		SD	24.60	4.86	---	6.61	4.32	88.75	10.63
	%♦		0.21↑	0.21↓	---	2.21↓*	7.28↓*	0.39↓	0.85↑
C O N T R O L	T1	X	84.73	19.05	27.42	39.13	14.44	132.06	87.40
		SD	14.44	6.94	9.18	7.31	6.88	14.68	10.68
	T2	X	85.76	19.93	27.27	38.10	13.97	137.00	89.31
		SD	14.53	7.91	9.47	7.48	11.60	16.16	11.16
	%♦		1.22↑*	4.62↑*	0.55↓	2.63↓	3.25↓	3.74↑*	2.18↑

NOTE: %♦ = percentage change between T1 and T2; * = significant at $p<0.05$.

management session in which the progressive muscular relaxation technique was practised (Jacobson, 1938). Group B only received the same psychological stress management session, as Group A, once a week. The Control group continued with its daily routine.

Medical care cost and absenteeism analysis: Each subject's medical care costs and absenteeism were calculated for six months prior to the study and six months during the study. This information was obtained from the Department of Correctional Services medical aid scheme. Unfortunately the reason for each medical claim and sick leave was not available.

Data analysis: All statistical analyses done were compiled and done by the statistical Department of the University of Pretoria using SAS and BMDP software packages. In all statistical analyses, the 95% level of confidence ($p< 0.05$) was applied as the minimum to interpret significant differences among sets of data.

RESULTS

Subjects: A drop-out rate of 18.13% was observed in this study. Nine of the subjects were transferred, five resigned from the Department of Correctional Services, two were discharged from the programme on medical grounds, while 15 indicated that they no longer wanted to participate in the study.

Physical parameters: Physical characteristics of the subjects are presented in Table 2. Analysis of the results showed that Group A had significant ($p<0.05$) improvements in all psycho-physiological parameters. Group B showed a significant improvement in trunk flexibility and a significant reduction in physical work capacity. The Control group had a significant increase in body mass, percentage body fat and systolic blood pressure with a decrease in physical work capacity.

Biochemical parameters: Changes in serum parameters are shown Table 3. Significant reductions were found in TC, LDL-C and uric acid concentrations in Group A, whilst the Control group had a significant increase in TC and fasting glucose levels whilst no significant changes were observed for HDL-C and TG levels.

Table 3: Changes in biochemical parameters of the subjects.

PARAMETERS								
GROUP			TC	LDC-C	HDL-C	TG	GLUCOSE	URIC ACID
A	T1	X	6.07	4.15	1.09	2.13	5.13	0.39
		SD	1.80	1.73	0.41	2.05	2.07	0.09
	T2	X	5.82	3.82	1.14	2.25	4.96	0.32
		SD	1.41	1.35	0.57	2.20	1.04	0.79
%♦			4.12↓*	7.95↓*	4.59↑	5.63↑	3.31↓	17.95↓*
B	T1	X	5.20	4.12	1.09	1.23	5.64	0.36
		SD	0.18	0.82	0.23	0.38	1.80	0.08
	T2	X	6.21	4.34	1.18	1.29	5.50	0.31
		SD	0.68	0.79	0.25	0.67	1.64	0.06
	%♦		19.42↑	5.34↑*	8.27↑	4.88↑	2.48↓	13.89↓
CONTROL	T1	X	5.64	3.73	1.03	1.98	4.74	0.35
		SD	1.20	1.02	0.32	1.55	0.77	0.11
	T2	X	5.86	3.78	1.05	2.44	5.06	0.34
		SD	1.24	1.17	0.34	2.55	0.83	0.12
	%♦		3.90↑*	1.34↑	1.94↑	23.23↑	6.53↑*	2.68↓*

NOTE: %♦ = percentage change between T1 and T2; * = significant at p< 0.05.

Table 4: Changes in the psychological stress levels, medical care cost and absenteeism of the subjects.

PARAMETERS							
GROUP			SOURCES OF STRESS	SYMPTOMS OF STRESS	VULNERABILITY TO STRESS	MEDICAL COSTS	WORK ABSENTEEISM
A	T1	X	2.62	1.48	5209	1362.77	5.66
		SD	10.00	10.00	10.00	2046.92	10.36
	T2	X	2262	8982	4714	616.81	2.59
		SD	10.00	10.00	10.00	858.76	3.60
%♦			13.74↓*	39.86↓*	9.61↑*	54.73↑*	54.24↓*
B	T1	X	4270	2002	5309	1583.38	4.75
		SD	10.00	10.00	10.00	1000.03	11.09
	T2	X	2161	8734	5018	1078.13	4.25
		SD	10.00	10.00	10.00	1199.90	8.78
	%♦		49.41↑*	56.50↑*	5.66↓	31.90↓	10.52↓
CONTROL	T1	X	2174	99	5003	721.08	3.52
		SD	10.00	10.00	10.00	1199.90	8.78
	T2	X	2276	9978	4305	951.77	5.58
		SD	10.00	10.00	10.00	1129.60	8.66
	%♦		4.6↑*	0	14.00↓*	31.99↑	58.52↑*

NOTE: %♦ = percentage change between T1 and T2; * = significant at p<0.05.

Psychological stress levels: Significant reductions in the total symptoms and sources of stress were shown in both Group A and Group B, however, only Group A had a significant reduction in its' vulnerability to stress. The Control group had a significant increase in total sources of stress and its' vulnerability to stress. These findings are summarized in Table 4.

Medical care cost and absenteeism analysis: Table 4 summarizes changes in medical care cost and absenteeism. Group A had a significant ($p = 0.0004$) decrease in medical expenditure resulting in a saving of a mean R745-96 per individual per 6 months and a significant mean decrease of 3,07 days in absenteeism. Group B showed no significant change. In contrast the Control group experienced, a non-significant ($p = 0.0625$), increase in medical cost which is equivalent to a mean increase of R230-69 and a significant mean increase of 2.06 days in absenteeism.

DISCUSSION

Participation compliance: The drop-out rate of 18.13% found in the present study compares favourably to the documented typical drop-out rate from supervised exercise programmes which may vary between 40 - 60% (Marcus *et al.*, 1992; Lechner & de Vries, 1995).

Possible explanations why the drop-out rate was so low are that members were allowed to exercise during work time (Dishman, 1994; Lechner & de Vries, 1995); facilities were situated on the work premises and were thus easily accessible (Shephard & Cox, 1980; Lechner & de Vries, 1995); all subjects volunteered to participate in the study thus all shared a positive attitude and beliefs about expected outcomes (Dishman, 1994); the subjects did not have to make any monetary contribution (Dishman, 1994); and finally, the exercise programme was individually tailored for 70% of the individuals maximal ability which thus eliminated the unfit subjects from perceiving a standard activity intensity as more strenuous than the fit subjects (Sallis *et al.*, 1986).

Physical evaluation

The effects of participation in a regular exercise programme on physical parameters have been well documented in previous studies (Daley & Parfitt, 1996; Grandjean, Oden, Crouse, Brown & Green, 1996).

Industrial programmes and regular participation in aerobic exercise programmes have consistently shown favourable changes in physical parameters (Duncan, Gordon & Scott, 1991; Grandjean *et al.*, 1996). The results of the present study (group A) support these findings in the following respects: A decrease in percentage body fat and body mass (Daley & Parfitt, 1996; Grandjean *et al.*, 1996), increase in number of sit-ups per minute (Blair *et al.*, 1986; Kahanovitz, Nordin, Yabut, Parnionpour, Viola. & Mulvihill, 1987); increase in trunk flexibility (Hubley, 1982); increase in physical work capacity (Duncan *et al.*, 1991; Grandjean *et al.*, 1996); decrease in resting systolic and diastolic blood pressure (Blair, Goodyear, Gibbons & Cooper, 1984); reduction in TC (Grandjean *et al.*, 1996); decrease in LDL-C levels (Pauly, Palmer, Wright & Pfeiffer, 1982; Grandjean *et al.*, 1996). The exercise stimulus of the present study was sufficient to elicit cardiovascular adaptations to exercise as Group A's physical work capacity improved. An improved physical work capacity has been said to lower resting blood pressure (Paffenberger, Wing, Hude & Jung, 1983; Blair *et al.*, 1984) and decrease TC levels (Grandjean *et al.*, 1996), which is supported by the findings of the present study.

Group A also experienced a decrease in psychological stress levels, and possibly a decrease in muscle tension (Girdano & Everly, 1986; Rice, 1992),which may partially explain the group`s increase in flexibility (De Vries, 1995; Heptinstall, 1995), decrease in TC levels and LDL-C levels (Burst, 1992). Research has shown that progressive muscular relaxation therapy on its own leads to a decrease in muscle tension which could result in an increase in flexibility. Group B which showed a decrease in psychological stress levels (Table 4) experienced only a small but significant increase in flexibility, a finding which could be similar to those of de Vries (1995) and Heptinstall (1995) who found.

Psychological progressive relaxation sessions have also been said to reduce TC levels. Studies (Roskies *et al.*, 1979; Cooper, 1982) have shown a reduction in cholesterol levels following a stress management intervention that emphasized training and practice in relaxation.

However not all studies have found such effect (Patel, Marmot, Terry, Carruthers, Hunt & Patel, 1985). The present study supports the latter research as Group B did not show any significant change in TC levels, a finding which may indicate that the changes in the TC levels of group A was probably due to the participation in the exercise programme. However, it does appear that one psychological progressive relaxation session is better than doing nothing at all, as the Control group showed a significant increase in TC levels which have been implicated to increase the risk of developing coronary heart disease (The Lipid Research Clinic, 1984; Burst, 1992). Another possible explanation for the changes is the decrease in Group A's percentage body fat and body mass which may explain the decrease in the group's resting blood pressure, TC and LDL-C levels as a proportional relationship between these individual parameters and body mass and/or percentage body fat exists (Reisin, Frohlich, Messerli, Dreslinski, Dunn, Jones & Baston, 1983; Goldberg & Elliot, 1994). Thus the significant increase in body mass and percentage body fat shown by the Control group may also explain the increase in the groups resting systolic blood pressure. Although a decrease in psychological stress levels has been implicated to yield some positive physiological changes, a meta-analysis by Crews and Landers (1987) demonstrated that irrespective of the types of measures used, aerobically fit individuals have a reduced psychosocial stress response. Studies strongly suggested that exercise can yield benefits for subjective well-being and may alter individuals' perceptions of stress and their ability to cope with it (Carrol, 1992). In Group A of the present study a decrease in the total sources of stress and vulnerability to stress was found. This indicated an altered perception of stress and an improved ability to cope with it. The control group had a significant decrease in vulnerability to stress with an increase in the total sources of stress. This could imply that the Control group's perception of stress may have deteriorated. Thus it would seem as if it is more beneficial if an aerobic activity be used to yield the reduction in psychological stress levels with the concomitant positive physical improvements that result as shown in this study.

According to Berger (1994) exercise was no more effective than other stress management techniques including progressive muscular relaxation technique. Berger (1994), however points out that the lack of superiority of exercise in no way denigrates its effectiveness. From the results of the present study it would appear that progressive muscular relaxation is more effective in reducing stress levels per se than aerobic circuit exercise programme. However Group B's results must be viewed with caution due to the small sample size. Thomas, Salazar and Landers (1991) state that when using $p \leq 0.05$ to prove significance a small sample size may result in a statistical analysis that provides a significant but not necessarily meaningful effect. Another possible explanation is that the subjects in Group B received greater individual attention as fewer subjects (n = 8) were present in the progressive muscular relaxation technique sessions compared to the 20 subjects handled simultaneously in Group A's sessions. When looking at the bigger picture the beneficial effects shown by Group A in the physical parameters (e.g. improved PWC, decrease in resting blood pressure, improved flexibility and abdominal strength, decrease in body composition and percentage bodyC and LDL-C) may outweigh the difference in the reduction of stress levels. In Group B the following parameters remained unchanged: body mass, percentage body fat, abdominal strength, PWC, resting blood pressure and all biochemical parameters except for LDL-C;, worsened (LDL-C) or showed improvement (flexibility). None of these changes - except an increase in LDL-C levels and flexibility were found in Group B. When the medical cost claims and work absenteeism are taken into account it is clear that the exercise programme used to decrease stress levels was far more economically beneficial than only progressive muscular relaxation.

Group A had lower medical care cost claims than the non-exercisers of comparable age from the Control groups. The decrease of 54.73% experienced by subjects in Group A is slightly higher than those in these studies, however the trend remains the same. According to Browne *et al.* (1984) an inverse relationship exists between the levels of cardiovascular fitness and medical health care costs.

This is supported by the findings in this study. The medical care costs discussed above can be viewed as the direct costs. The indirect costs which include productivity loss, decrease in quality of output, increased employee turnover and an increase in work absenteeism. Group A's decrease of 54.24% in work absenteeism and the Control group's of 58.52% are consistent with results from previous studies (Shephard, 1992). This shows that a comprehensive multi-component health promotion programme may have a positive effect on aspects of productivity such as absenteeism (Daley & Parfitt 1996; de Beer, 1997).

CONCLUSIONS

The stress management exercise programme employed in this study yielded favourable changes in physical parameters, psychological stress levels, medical care costs and work absenteeism on South African Correctional Services personnel.

One limitation of the current study is that it has concentrated on potential benefits of a stress management programme without considering programme costs (Shephard, 1987; Kiely & Hodgson, 1990). Additional indirect costs of such programme include salaries for registered biokineticists and psychologists needed to implement and supervise the programme as well as costs of facilities needed (Oster & Epstein, 1986; Shephard, 1987). In considering cost-benefits trade-offs, a company may want to go beyond potential economic benefits and concentrate on the improvement of employee health and lifestyle as justification for this investment (Shephard 1987). Furthermore, research concerning exercise mode, practice and environmental factors that might influence the stress benefits of exercise should be considered (Berger, 1994; Plowman, 1994). Important goals for future research are to determine whether the findings can be generalized to other work sites, and if so, whether these benefits can be sustained over a long period of time. On the basis of the data of the present study it would appear that a stress management exercise programme may offer substantial benefits not only to employees, but also the organisations that choose to implement such a programme.

The long-term aim for the Department of Correctional Services should be to develop programmes that will reach all personnel by adopting a multi disciplinary approach, and thus help employees to appreciate that good psychological and physical health are essential components of a higher quality of life.

REFERENCES

American College of Sports Medicine (1991). *Guidelines for Exercise and Prescription.* Philadelphia: Lea and Febiger.

Berger, G.B. (1994). Coping with stress: The effectiveness of exercise and other techniques. *Quest*, 46(1), 100-119.

Blair, S.N., Goodyear, N.N., Gibbons, L.W. & Cooper, K.H. (1984). Physical fitness and incidence of hypertension in healthy normotensive men and women. *Journal of the American Medical Association*, 252(4), 487-490.

Blair, S.N., Kohl, H.W., Gordon, N.F. & Paffenberger, R.S. (1992). How much physical activity is good for health? *Annual Review of Public Health*, 13, 99-126.

Blair, S.N., Oiserchia, P.V., Wilbur, C.S. & Crowder, J.H. (1986). A public health intervention model for work-site health promotion: Impact on exercise and physical fitness in a health promotion plan after 24 months. *Journal of the American Medical Association*, 255(5), 921-926.

Browne, D.W., Russel, M.L., Morgan, J.L., Scott, A., Optenberg, R.N. & Clarke, A.E. (1984). Reduced disability and health care costs in an industrial fitness program. *Journal of Occupational Medicine*, 26(11), 809-819.

Burst, R. (1992). *The Cholesterol Myth: The New Healthy Heart Programme.* Sydney: Pan MacMillan Publishers.

Carroll, D. (1992). *Health Psychology: Stress, Behavior and Disease.* London: Falmer Press.

Cheek, F.E. & Miller, S.E. (1983). The experience of stress for correctional officers: A double blind theory on Correctional Stress. *Journal of Criminal Justice*, 11(2), 105-110.

Cooper, M.I. (1982). Effect of relaxation on blood pressure and serum cholesterol. *Psychological Bulletin*, 92(7), 410-433.

Cooper, C.L. (1985). *Sunday Times Career Guide*, p.11.

Crews, D.J. & Landers, D.M. (1987). A meta-analytic review of aerobic fitness and reactivity to psychological stressors. *Medicine and Science in Sport and Exercise*, 19, (Suppl.), S114-S120.

Daley, A.J. & Parfitt, G. (1996). Good health-Is it worth it? Mood states, physical well-being, job satisfaction and absenteeism in members and non-members of a British corporate health and fitness club. *Journal of Occupational and Organizational Psychology*, 69(2), 121-134.

De Beer, S. (1997). The Effect of a Multipurpose Physical Training Programme on Chronic Low Back Pain. Unpublished MA Thesis. Pretoria: University of Pretoria.

De Vries, H.A. (1995). Tension reduction with exercise. In T. Everett, M. Dennis & E. Ricketts (Eds.), *Physiotherapy in Mental Health: A Practical Approach* (pp.99-104). Oxford: Butterworth Heinemann Ltd.

Dishman, R.K. (1994). The measurement condrum in exercise adherence research. *Medicine and Science in Sports and Exercise*, 26(1), 95-103

Drinkwater, D.T. & Ross, W.D. (1980). Anthropometric fractionation of body mass. In M. Ostyn, G. Beunen and J. Simmons (Eds.), *Kinanthropometry II* (pp. 178-189). Baltimore: University Press.

Duncan, J.J., Gordon, N.F. & Scott, C.B. (1991). Women walking for health and fitness: How much is enough? *Journal of the American Medical Association*, 266(23), 3295-3299.

Gilligan, I., Fung, L., Piper, D.W. & Tennant, C. (1987). Life event stress and chronic difficulties in duodenal ulcers: A case control study. *Journal of Psychosomatic Research*, 31(2), 117-123.

Girdano, D.A. & Everly, G.S. (1986). *Controlling Stress and Tension: A Holistic approach.* Englewood Cliffs, N.J.: Prentice-Hall.

Goldberg, L. & Elliot, D.L. (1994). *Exercise for Prevention and Treatment of Illness.* Philadelphia: F.A. Davis Company.

Grandjean, P.W., Oden, G.L., Crouse, S.F., Brown, J.A. & Green, J.S. (1996). Lipid and lipoprotien changes in women following 6 months of exercise training in a worksite fitness prograr *Journal of Sports and Physical Fitness*, 36(1), 54-59.

Grossi, E.L. & Berg, B.L. (1993). Stress and job dissatisfaction among correctional officers: an unexpected finding. *International Journal of Offender Therapy and Comparative Criminology*, 37(2), 73-81.

Harenstam, A., Palm, U.B. & Theorell, T. (1988). Stress, health and the working environment of Swedish working staff. *Work and Stress*, 2(4), 281-290.

Heptinstall, S.T. (1995). Stress management. In M. Dennis, T. Everett & E. Ricketts.(Eds.) *Physiotherapy in Mental Health: A Practical Approach.* Oxford: Butterworth Heinemann Ltd.

Hinkle, L.E. (1987). Stress and disease: The concept after 50 years. *Social Science and Medicine*, 25(6), 561-566.

Hubley, C. (1982). Testing flexibility. In D. McDougall, W. Wenger & H. Green (Eds.), *Physiological Testing of the Elite Athlete* (pp.117-132). Ottawa: Canadian Association of Sport Science.

Irwin, J. & Anisman, H. (1984). Stress and pathology: Immunological and central nervous system interactions. In C.L. Cooper (Ed.), *Psychosocial Stress and Cancer* (pp. 44-60). United Kingdom: John Wiley and Sons.

Ivancevich, J.M. & Matteson, M.T. (1988). Type A behaviour and the healthy individual. *British Journal of Medical Psychology*, 61(2), 37-51.

Jacobson, E. (1938). *Progressive Relaxation: A Physiological and Clinical Investigation of Muscle States and their Significance in Psychology and Medical Practice* (2nd ed.). Chicago: University of Chicago Press.

Kahanovitz, N.M., Nordin, R.V., Yabut, S., Parnionpour, M., Viola, K. & Mulvihill, M. (1987). Normal trunk muscle strength and endurance in women and the effect of exercises and electrical stimulation and exercises to increase trunk muscle strength and endurance. *Spine*, 12(2), 112-118.

Kiely, J. & Hodgson, G. (1990). *Stress in the Prison Service: The Benefits of Exercise Programs.* Travistock: Institute of Human Relations.

Kirkendall, D.R., Gruber, J.J. & Johnson, R.E. (1980). *Measurement and Evaluation for Physical Educators.* Dubuque, Iowa: Wm. C. Brown Company Publishers.

Krantz, D.S. & Manuck, S.B. (1984). Acute psychophysiologic reactivity and risk of cardiovascular disease: A review and methodologic critique. *Psychological Bulletin*, 96(3), 435-464.

Kraus, H. & Raab, W. (1961). *Hypokinetic Disease: Diseases Produced by Lack of Exercise.* Springfield, Ill: Charles C. Thomas.

Lechner, L. & De Vries, H. (1995). Participation in an employee fitness program: Determinants of high adherence, low adherence and dropout. *Journal of Occupational and Environmental Medicine*, 37(4), 429-436.

Marcus, B.H., Banspach, S.W., Le Febbre, R.C., Rossi, J.S., Carleton, R.A. & Abrams, D.H. (1992). Using the stages of change model to increase the adoption of physical activity among community participants. *American Journal of Health Promotion*, 6(4), 424-429.

Miller L.H. & Smith, A.D. (1983). *Stress Audit.* Boston: Biobehavioral Associates.

Miner, J.B. & Brewer, J.F. (1976). Management of ineffective performance. In M.D. Dunette (Ed.), *Handbook of Industrial and Organizational Psychology* (pp. 45-60). New York: John Wiley and Sons.

Oster, G. & Epstein, A.M. (1986). Primary prevention and coronary heart disease: The economic benefits of lowering serum cholesterol. *American Journal of Public Health*, 76(6), 647-655.

Paffenberger, R.S., Wing, A.L., Hyde R.T. & Jung, D.L. (1983). Physical activity and incidence of hypertension in college alumni. *American Journal of Epidemiology*, 117(3), 245-257.

Park, R.J. (1989). Healthy, moral and strong: educational views of exercise and athletics in 19th century America. In K. Grover (Ed.), *Fitness in American Culture: Image of Health, Sport and Body 1830-1940* (pp.38-59). Amherst, Massachusetts: Amherst University.

Patel, C.H., Marmot, M.G., Terry, D.J., Carruthers, M., Hunt, B. & Patel, M. (1985). Trial of relaxation in reducing coronary risk: Four-year follow-up. *British Medical Journal*, 290(6), 1103-1106.

Pauly, J.J., Palmer, J.A., Wright, C.C. & Pfeiffer, G.J. (1982). The effect of a 14-week employee fitness program on selected physiological and psychological parameters. *Journal of Occupational Medicine*, 24(6), 447-463.

Plowman, S.A. (1994). Stess, hyper-reactivity and health. *Quest*, 46(2), 78-99.

Reisen, E., Frohlich, E.D., Messerli, F.H., Dreslinski, G.R. Dunn, F.G., Jones, M.M. & Baston, H.M. (1983). Cardiovascular changes after weight reduction in obesity hypertension. *Annals of Internal Medicine*, 98(3), 315-319.

Rice, P.L. (1992). *Stress and Health* (2nd ed). Pacific Grove, CA: Brooks/Cole.

Roskies, E., Kearney, H., Spevack, M., Surkis, A., Cohen, C. & Gilman, S. (1979). Generalizability and duration of treatment effects in an intervention programme for coronary prone (Type A) managers. *Journal of Behavioral Medicine*, 2(2), 195-207.

Sallis, J.F., Haskell, W.L., Fortman, S.P., Vranizan, K.M., Taylor, C.B. & Solomon, D.S. (1986). Predictors of adoption and maintenance of physical activity in a community sample. *Preventative Medicine*, 15(4), 331-341.

Shephard, R.J. & Cox, M. (1980). Some characteristics of participants in an industrial fitness programme. *Canadian Journal of Applied Sports Science*, 5, 67-76.

Shephard, R.J. (1992). Twelve years experience of a fitness program for the salaried employee of a Toronto life assurance company. *American Journal of Health Promotion*, 6(4), 292-301.

Shephard, R.J. (1987). *Fitness Programs and Industrial Stress*. Liverpool England: Economics Research Society International Conference on Sport, Leisure, and Ergonomics (pp. xi-xxx).

Shillitoe, R.W. (1988). *Psychology and Diabetes: Psychosocial factors in Management and Control*. London: Chapman and Hall.

Smit, P.J. (1979). *Growth and Sport*. Durban: Butterworth

Sutherland, V.J. & Cooper, C.L. (1990). *Understanding Stress: A Psychological Perspective for the Health Profession*. London: Chapman and Hall.

The Lipid Research Clinics Program. (1984). The Lipid Research Coronary Primary Prevention Trial Results: II. The relationship of reduction in incidence of coronary heart disease to cholesterol lowering. *Journal of the American Medical Association*, 251(3), 365-374.

Theorell, T. (1986). Characteristics of employment that modify the risk of coronary heart disease. In S. Walt & A. Firestone (Eds.), *Occupational Stress: Health and Performance at Work*. (pp.114-140). New York: Plenum Press.

Thomas, J.R., Salazar, W. & Landers, D.M. (1991). What is missing in $p<.05$ effect size? *Research Quarterly for Exercise and Sport*, 62(3), 344-348.