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THE EFFECT OF A PHYSICAL AND A COMBINED HEALTH PROMOTION INTERVENTION PROGRAMME ON SOME SELECTED HEALTH INDICATORS OF SOUTH AFRICAN COLLIERY EXECUTIVES

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ABSTRACT

In many countries the focus of the employer's health policy has shifted from the emphasis of treating the disease to the preventative paradigm, which focuses more on the promotion of employees' health. Various ramifications of wellness strategies, claiming positive results can be found in the literature. The purpose of this study was to compare a conventional physical fitness programme to a physical fitness programme enriched with health promotion activities. In this study 143 male executives from 5 collieries, aged 26-58 years ($\overline{x}$ = 41.7, ± 7.98 years) participated as an availability, non-randomized sample. The subjects were then randomly stratified into a control (C) group (n=66) who was subjected to a conventional physical fitness intervention and an experimental (Exp) group (n=77) who followed a physical fitness as well as a health promotion regimen for 32 weeks. Assessments were done at baseline (before starting), 16 weeks and 32 weeks. The following statistically significant improvements were found: aerobic fitness (Exp at 16 and 32 weeks), shoulder/arm strength/endurance (Exp at 32 weeks, and C at 16 and 32 weeks), abdominal strength /endurance (C at 16 and 32 weeks), flexibility (Exp at 16 and 32 weeks), BMI (C at 16 and 32 weeks) Systolic (C at 16 and 32 weeks) and diastolic (C at 16 weeks and Exp at 32 weeks) blood pressure at rest. No change was found in total cholesterol concentration. No additional improvements thus occurred from week 16 to week 32.

Key words: Executives; Health promotion; Health; Health care costs.

INTRODUCTION

In industrialized countries modern technology has largely eliminated the need for physical exertion (Bolton, 2004:71). Research by Jacobs (1991:64), Van Zyl (1995:iv, 31) and Dreyer (1996:131) also confirms this scenario in South Africa. They maintain that due to modernising, technological development and business demands, the South African executive finds him/herself in a stressful and often hypokinetic environment. As maintained by Dreyer and Strydom (1994:1) only 3% of South African executives are physically active at work while 20.6% were adequately physically active to ensure a salutogenic effect outside the working environment (Dreyer, 1996:133). Bolton (2004:78) reported 31% of the executives to be highly active during their leisure time. As far as the physical fitness status of some South African executives is concerned, Jacobs (1991:125) indicated a low 1.9 watt.kg^{-1} compared to the average physical working capacity (PWC_{170}) value of 2.5 watt.kg^{-1}, as established by Jones and Campbell (1982:250). According to Strydom *et al.* (1998:123), 74% of the white male executives from the construction, steel, mining, motor and financial industries indicated a low physical fitness score, while 5% of the respondents showed a body fat percentage of >25, placing them in a high health risk category. Furthermore, it also became clear from Swanepoel (2001:100) that 75.6% of the executives follow a moderate or unhealthy lifestyle with an inability to establish a balance between their work, family and relaxation (Dreyer & Strydom, 1994:11).

From the above it is clear that the physical profile as well as the lifestyle of executives portray a fairly unhealthy scenario which can lead to a state of hypokinesis, an increased risk for the developing of coronary heart diseases, a reduction in health status and quality of life which may eventually result in premature death (Booth *et al.,* 2000:774-787; Bolton *et al.,* 2004:56; American Heart Association, 2005).

The need for employers to conserve their investment in the employees (human capital) became evident over the last decade. Organizations, therefore, strive to identify the leading health cost drivers – both direct and indirect (e.g. medical, absenteeism, disability, presenteeism) because emerging research is documenting that indirect costs of poor health can be two to three times the direct medical costs (Burton *et al.,* 2004:S38). It is at this point that companies have to realise the importance of worksite health promotion intervention, not only to reduce health care costs but also to provide a strategy for a dynamic work environment (Pfeiffer, 2003:116) and to prevent employees from migrating into higher health risk categories (Musich *et al.,* 2003:393).

For the past two decades the emphasis of most health promotions and evaluative research at the workplace has been on physical risk factors and physical health status (O'Donnell, 2002: 1). Given the medical genesis of health promotion and the overwhelming research supporting the relationship between physical health, morbidity and mortality, this focus on the physical dimension is not unexpected (O'Donnell, 2002:xx). It is well known that a physically active lifestyle enhances general health, reduces the risk for coronary heart diseases and ensures quality of life (Willmore, 2001:S622-S633). This focus on the physical dimension later became insufficient and health promotion programmes consequently expanded to a more holistic view on employee health, focusing on primary, secondary and tertiary prevention strategies for employees that resulted in better compliance and sustained improvement (Randolfi, 2006:1).

In South Africa no literature is available at present comparing a physical intervention to an enriched health promotion programme where other wellness dimensions were also incorporated. The motivation of this study was, therefore, to go beyond focusing on physical fitness only as an intervention regimen, but to enrich the intervention with other health promotion intervention activities.

METHODS

Subjects

In this study an availability, non-randomized sample of 143 male executives from five collieries aged 26-58 ($\bar{x}$ = 41.7, ± 7.98 years) were used. These collieries are spread over two South African provinces, namely Mpumalanga and Gauteng. Subjects on medication that could affect their cholesterol, blood pressure and aerobic fitness values were excluded from the study.

The subjects were randomly assigned to either a control group (n=66) or an experimental group (n=77). The experimental group was exposed to a physical and a health promotion intervention for eight months (32 weeks) while the control group was only exposed to a conventional physical fitness intervention. The subjects were assessed on three occasions, namely before they started, 16 weeks after and a final assessment 32 weeks thereafter.

Measurements

The following parameters were used in this study:

Aerobic fitness: - The protocol, as described by the American College of Sports Medicine (ACSM, 2000:76), was used to determine the executives' aerobic fitness by means of a 3-minute sub maximal step test on a Reebok step-up bench. The recovering heart rate ($b.min^{-1}$) counted for 15 seconds after cessation of the test served as the fitness score.
Shoulder/arm- strength/endurance (push-ups): - The procedure, as explained by the ACSM (2000:84), was used to determine the executives' shoulder/arm (push-ups) strength/endurance. The maximal numbers of push-ups performed in one minute consecutively without rest was noted as the score.
Abdominal strength/endurance (sit-ups): - The procedure, as explained by the ACSM (2000:84), was used to determine the executives' abdominal strength/endurance (sit-ups). Within a one-minute period, the executive performed as many sit-ups as possible (elbows touching knees) which indicated the abdominal endurance.
Flexibility: - A sit-and-reach box was used primarily to determine the flexibility of the hamstring musculature and lower back. The measurement was taken to the nearest centimetre according to the protocol as described by the ACSM (2000:87).
Body mass index: - The procedure, as suggested by the ACSM (2000:63), was used to determine the executives' body mass index by dividing the body mass (kg) by the height in metres squared ($kg.m^{-2}$).
Blood pressure: - An ALPK2 aneroid sphygmomanometer was used to determine arterial blood pressure according to the protocol as described by ACSM (2000:40). The first Korotkoff sound was used to determine systolic blood pressure, while the diastolic blood pressure was determined using the 4^{th} Korotkoff sound.
Cholesterol: - For the determination of total cholesterol concentration the Accutrend GC was used by taking an arterial blood specimen from a finger prick. The machine was calibrated by using the batch related calibration strip before the assessment. According to the literature, a fasting period prior to the assessment of total cholesterol is not necessary for screening purposes (BioDoc, 2000:16-18).

Procedure

The assessment of the executives' physical, physiological and bio-chemical health indicators commenced immediately after an explanation of the tests and procedures. All assessments were conducted by a registered biokineticist. A specific sequence for the assessments was followed. The assessment commenced with the physiological parameters (blood pressure) followed by the bio-chemical (cholesterol) with the physical parameters (body mass and height, flexibility, aerobic fitness, muscle strength/endurance), concluding the session.

Intervention

This programme was introduced to both groups by means of a general health and fitness orientation by the biokineticist. The two intervention programmes were then explained to all the subjects. The experimental group was exposed to a physical and a health promotion intervention for eight months while the control group followed only the physical part as an intervention.

Physical intervention

The ACMS's guidelines for improvement of fitness and general health, based on the FITT-principle (frequency, intensity, time & type), were used as the basis for their training programme (Durstine & Moore*,* 2003:96). The FITT-principle was applied, tailored to the executives' medical history, physical, physiological and bio-chemical results. Each executive's programme was subscribed on a card to be followed at a fully equipped gymnasium on site or at the nearest available gymnasium in town. The two re-assessment dates on 16 and 32 weeks were stipulated on the training card as well as columns to tick whether an exercise session was completed, in order to monitor programme adherence. For the duration of the study (32 weeks) the exercise programmes were adjusted every 2-4 weeks to ensure progress by increasing the exercise intensity as well as resistance.

Each exercise session included a warm-up and cool-down phase where basic stretching exercises were performed (quadriceps, hamstring, calf, triceps and shoulder). The aerobic part of the programme (20–30 minutes) started at an intensity of 60–65% of the age adjusted maximal heart rate. The individual target heart rate for every participant was determined by using the formula of Karvonen (ACSM, 2000:147). Participants could choose from any five of the accessible types of aerobic activities such as cycling, walking, stepping, rowing and jogging. The reason for this flexibility was to accommodate for the executives' busy schedules, their personal exercise preferences and frequent travelling. The RPE – scale (ACSM, 2000:79) was used to monitor the intensity of the aerobic part of the programme. Each participant was taught to apply the scale during each session. Resistance exercises were included for the improvement in muscle strength and endurance for the lower and upper body muscles using free or fixed weights. The initial programme was set at 2 sets of 12–15 repetitions, of which the weight was gradually increased after every assessment. The first training session and every time when adjustments were made, were performed under the supervision of the researcher. For the duration of the 32 weeks, subjects had to train on their own without supervision. They could, however, contact the researcher if anything was unclear.

Feedback on the results was given by the researcher immediately after completion of the physical re-assessments. Any complaints or adverse symptoms were addressed and continuous participation was encouraged. The exercises were done during executive's leisure time. The company offered no incentives for participation in the programme.

Health promotion intervention activities

The health promotion intervention activities presented to the experimental group entailed informative sessions on exercise and nutrition, physical stress management and lower back pain. The aim of these health promotion activities was to promote the health and/or reduce illness-producing lifestyle habits of the executives – inter alia to comply with the exercise programme as part of a healthy lifestyle. Another aim was to foster awareness, influence attitudes to accept self responsibility for their health and wellness and identify alternatives that will enable them to make informed choices and change their habits in order to achieve an optimum level of physical and mental health and improve the physical and social environment. The duration of these sessions was 30-45 minutes presented every eight weeks to the experimental group. Additionally, this group also followed the physical intervention as described earlier.

Statistical analysis

Statistical analysis of the data was done on the Statistica programme available on the intranet of the North-West University by using ANOVA repetitive testing. Tukey post-hoc tests were used to determine whether certain groups differ statistically significantly from each other (Tabachnick & Fidell, 2001:475-482; Statsoft, 2004).

RESULTS

Descriptive data of the experimental and control group are presented in table 1. It must be emphasized that both groups were exposed to a physical intervention programme, the only difference, however, was that the experimental groups' physical programme was enriched with health promotion activities. From table 1 it appears that both groups improved in all physical parameters after the first 16 weeks of intervention (test 2).

Statistically significant differences occurred within the following parameters: aerobic fitness (experimental group), abdominal strength/endurance, shoulder/arm strength/endurance, BMI (control group) and flexibility (experimental group). Furthermore, the average baseline values of the shoulder/arm strength/endurance were in the ”good” category (Grace, 2006:152), while the abdominal endurance, aerobic capacity and flexibility scores were categorized as ”average” (Grace, 2006:152). The BMI score of both groups reflects an overweight interpretation (ACSM, 2000:64).

For the next 16 weeks of intervention (T2–T3) the experimental group indicated slight, but no statistically significant changes (improvement) in the aerobic fitness and BMI, while the control group showed improvement in abdominal strength/endurance. None of these changes were statistically significant.

Between the baseline (T1) and final assessment (T3), statistically significant improvements occurred within the experimental group in aerobic fitness, shoulder/arm strength and flexibility. The control group indicated statistically significant improvements in abdominal strength/endurance, shoulder/arm strength and BMI. Some non-significant improvements were found within the experimental group in the abdominal strength/endurance and BMI parameters, while the control group showed non-significant improvement in aerobic fitness.

TABLE 1: **DESCRIPTIVE DATA OF THE EXECUTIVES (EXPERIMENTAL & CONTROL) FOLLOWING DIFFERENT HEALTH PROMOTION PROGRAMME**

		TEST 1			TEST 2			TEST 3		
Parameters	**Group**	**N**	$\bar{X}$	**SD**	**N**	$\bar{X}$	**SD**	**N**	$\bar{X}$	**SD**
Aerobic fitness ($b.min^{-1}$)	Experimental	65	112 [2,3]	16	39	104 [1]	16.6	37	100 [1]	14.8
	Control	57	115	19.8	44	109	19.1	37	112	17.5
Abdominal strength/ endurance (sit-ups/.min^{-1})	Experimental	71	27	9.8	48	29	8.3	45	29	8.6
	Control	65	27 [2,3]	8.7	54	29 [1]	8.0	50	30 [1]	9.1
Shoulder/arm strength/endurance (push-ups/.min^{-1})	Experimental	72	29 [3]	9.6	50	30	8.0	47	30 [1]	8.8
	Control	64	27 [2,3]	11.1	51	30 [1]	11.7	49	30 [1]	11.3
Flexibility (cm)	Experimental	77	32 [2,3]	9.3	51	34 [1]	9.4	50	34 [1]	9.4
	Control	66	34	8.9	54	35	9.3	51	34	9.5
Body mass index ($kg.m^{-2}$)	Experimental	77	28.2	3.8	55	28.0	3.8	52	27.9	3.3
	Control	66	29.1 [2,3]	4.6	54	28.9 [1]	4.0	52	28.9 [1]	4.1
Systolic blood pressure (mmHg)	Experimental	65	117	13.8	47	113	13.8	44	113	14.1
	Control	57	124 [2,3]	15.1	46	117 [1]	16.4	44	117 [1]	14.1
Diastolic blood pressure (mmHg)	Experimental	65	76 [3]	11.3	47	75	13.7	44	73 [1]	11.5
	Control	57	83 [2]	9.5	46	77 [1]	11.7	44	80	10.2
Cholesterol ($m.mol.l^{-1}$)	Experimental	65	5.1	1.02	46	5.1	0.86	43	5.1	0.75
	Control	57	5.3	0.93	46	5.4	0.76	44	5.2	0.71

*Statistically significant intragroup differences are indicated by the small numbers 1, 2 or 3, next to the mean value indicative of test 1, 2 or 3. For example, the 2 & 3 next to the mean of test 1 in aerobic fitness indicates statistically significant differences between test 1 and test 2, as well as test 1 and test 3.
** No statistically significant intergroup differences were evident in the three assessment intervals

Regarding the physiological parameter both groups improved in the systolic (table 1) and diastolic blood pressure after 16 weeks (test 2), but only the systolic and diastolic blood pressure of the control group showed a statistically significant difference to test 2. After 32 weeks both group's systolic blood pressure (test 3) remained the same as in test 2 but still better than the baseline values. The improvement in the systolic blood pressure of the control group (test 1-3) was statistically significant. It must be mentioned that both group's baseline values were categorized as "good" (Grace, 2006:153) and, therefore, a significant "improvement" was not anticipated. The diastolic blood pressure of the experimental group showed a non significant improvement from test 2 to test 3 while the diastolic blood pressure of the control group was higher at test 3 (80mmHg) than in test 2 (77mmHg). Again all blood pressure responses of both groups can be categorized as "good" (ACSM, 2004:40).

The bio-chemical parameter (cholesterol) of the experimental group stayed the same in all three assessments, namely 5.1m.mol.l^{-1}. The cholesterol concentration of the control group increased slightly after the first 16 weeks (test 2) to 5.4m.mol.l^{-1} with a decrease after the next 16 weeks of intervention (test 3) (5.2m.mol.l^{-1}). However, these changes were not statistically significant. The total cholesterol concentration of the experimental group, as well as the control group, fall in the ”good” and ”average” category respectively in all three assessments (Grace, 2006:153).

DISCUSSION

From the results it is clear that basically two patterns unfold during the 32 weeks of this survey. After the first 16 weeks an improvement occurred in all parameters assessed in both the experimental- and control group, although all changes were not statistically significant. However, it **should be noted that** all baseline values – except the BMI were within the “good” or average categories (Grace, 2006:153). The baseline value for BMI in both groups could be categorized as overweight (ACSM, 2000:64) and, therefore, the only parameters to be regarded as a health risk.

After the next 16 weeks of the intervention no uniform trend could be found in either of the groups. During this phase three trends were identified. Firstly, no change was found in the following parameters; abdominal strength/endurance (experimental group), shoulder/arm strength/endurance (experimental and control group), flexibility (experimental group), BMI (control group), systolic blood pressure (experimental and control group) and cholesterol (experimental group). In this case the initial improvements were sustained. Secondly a further improvement appeared in aerobic fitness (experimental group), abdominal strength/endurance (experimental group), BMI (experimental group), diastolic blood pressure (experimental group) and cholesterol (control group). None of these changes, however, were statistically significant. Lastly the following parameters: showed a decline: Aerobic fitness (control group), flexibility (control group) and diastolic blood pressure (control group). Again, none of these changes were statistically significant.

Although all physical parameters (except BMI) could be classified in the “good and average” categories, one would expect an improvement in these parameters following the last 16 weeks of intervention. This, however, only happened in some physical parameters as described in trend 2 above and none of the changes that took place were statistically significant. The reason for this must probably be sought in the programme adherence of the participants.

In an unsupervised programme as is relevant in some companies, the responsibility of adhering to the prescribed exercise rests with the participant. Research has indicated that deadlines, time constraints, travelling to the various sites as well as abroad and personal preferences are posing some barriers to comply with a prescribed intervention. This mobility of participants was the prime reason for the flexibility which was built into this programme regarding the frequency (3–5 times per week) and choice of the type of aerobic activity (cycling, walking, stepping, rowing and jogging). In order to get these highly skilled employees to follow a healthy lifestyle, any intervention programme has to be tailored to the personal preference and availability of facilities, and strategies should be put in place to keep up their interest in the programme. According to Franklin (in Dishman, 1988:238), participants tend to lose interest in an exercise programme resulting in a low adherence rate and eventually insignificant responses. According to Pollock (in Dishman, 1988:262), the highest dropout rate occurs after 12 weeks of participation. This is especially true when a full time and enthusiastic programme leader is not available – as in the case with unsupervised programme (Gettman in Dishman, 1988:354). Franklin (in Dishman, 1988:239) is of the opinion that programme and personal factors can also influence programme adherence. In this respect Shephard (in Dishman, 1988:239) indicated that participants tend to adhere more to exercise for the developing of muscle strength such as weights and dumbbells than to aerobic activities. It is interesting to note that in this study both groups showed an improvement after the first 16 weeks of intervention. For the next 16 weeks no uniform trend was noticed. Although both groups reported an average compliance rate of two times per week, it could be possible that some of the participants lost interest which resulted in lower compliance. Because of the unsupervised nature of the programme, personal exercise preference may also be a possibility where the participants tend to do only the part of the programme that they like. From the results it is clear that both groups showed a continuous improvement in abdominal and shoulder/arm strength and endurance, while only the experimental group showed a continuous increase in aerobic endurance. The fact that aerobic training takes more time than the strength training may in part have affected the subjects' preference. Therefore, not only an attendance logbook is important where the participants must indicate their programme attendance but also a quality logbook where they should indicate whether they comply to the full programme or only partially. It could be the case that as a result of time constraints a participant may do only some parts of the programme, which could affect the outcome of the intervention.

CONCLUSIONS

The results of the study indicate that the executive employees studied showed an improvement in the physical and physiological parameters following the intervention of the first 16 weeks. For the next 16 weeks no uniform trend existed. The reason for this may vary from respondents already showing "normal" baseline values, to programme preference and adherence.

The outcomes of the two intervention regimes indicated no statistically significant differences, suggesting that none of the programmes were superior. Therefore, this study showed no additional benefit of an enriched health promotion programme over that of the traditional physical intervention programme. It must, however, be kept in mind that only physical, physiological and biochemical parameters were assessed, while the promotional talks mainly focused on topics not assessed.

From this study it is clear that unsupervised programmes challenge the programme leader to apply motivational strategies continuously to keep up the interest of the participants. Detail logbooks - not only regarding attendance but also on the quality of attendance should be implemented to ensure optimal benefits from the intervention programmes. It is also possible that an increased frequency of health talks (not every eight weeks as in this study) could impact more on the compliance and quality of adherence.

Lastly it is recommended that similar research is conducted on high risk employees in order to ascertain the effect or the two types of intervention regimes.

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