THE EFFECT OF PRESCRIBED AND SELF-PRESCRIBED, SELF-MONITORED EXERCISE PROGRAMS ON THE PHYSICAL FITNESS AND PSYCHOLOGICAL WELL-BEING OF OLDER ADULTS

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ABSTRACT

There has been much interest surrounding the possible existence of a mutually positive relationship between physical fitness and psychological well-being. This nine week, pre/post-test experiment investigated the effects of a self-monitored, prescribed and a self-monitored, self-prescribed exercise program on the physical fitness and the psychological well-being of individuals 50 - 90 years of age. Fifty-seven subjects (males=30, females=27) with an average age of 68.50 years completed the study. Subjects were randomly divided into three groups. Group 1, the Control Group, was requested to continue with their present level of physical activity over the nine week period. Group 2, the self-prescribed experimental group, was requested to develop and monitor their own exercise program using exercises from the book Recipes for Fitness After 50: Personalized Exercise Programs (PEP)! (Bell, 1990). Group 3, the prescribed experimental group, was assigned specific exercises to be performed from the same book. All subjects self-monitored their participation. Physical fitness levels were measured by cardiovascular endurance, muscular strength and endurance and flexibility scores on the Post 50 Physical Performance Test (Bell, Collis and Hoshizaki, 1985). Psychological well-being levels were measured by self-esteem, depression, personal control, symptoms of aging and social satisfaction scores on the Self

Evaluation of Life Function (SELF) Scale (Linn and Linn, 1984). A multivariate analysis of variance showed that there were some time and sex differences but no group differences. Males in Group 3 significantly ($p<.01$) improved in Modified Push-Ups while females in Group 3 significantly ($p<.01$) improved on the Two Minute On-the-Spot Walk. Males in Group 2 showed no significant ($p<.05$) physical fitness improvement; however, the females significantly improved in Curl-Ups ($p<.01$), Push-Ups ($p<.01$) and Sit and Reach ($p<.05$). Males in Group 1 significantly improved in the Two Minute On-the-Spot Walk ($p<.01$), Curl-Ups ($p<.01$) and Push-Ups ($p<.05$) while females in Group 1 improved in Push-Ups ($p<.01$). Group 3 females were the only subjects to experience a significant improvement on a psychological well-being measure; significantly ($p<.05$) increasing their level of self-esteem. Overall, this study offers limited support for the existence of a positive relationship between physical fitness and psychological well-being in older adults.

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DEDICATION

To my parents,

Bill and Karin Graham,

for their never ending love and support,

and for encouraging me to strive

and to be all that I can be.

INTRODUCTION

The average age of the Canadian population has increased with each decade. At the beginning of the twentieth century just 5% or 272,000 Canadians lived past 65 years of age (Canadian World Almanac, 1990). In 1951, this number had quadrupled to 1,086,000 people or 7.7%. By 1986, 10.6% or 2,697,000 Canadians lived past 65 years of age (Canadian World Almanac, 1990). By the year 2000, it is expected that 3.2 million Canadians will live past 65 years of age (Burdman, 1986).

In 1976, 50% of the individuals 65 years of age and over were physically active; by 1981 this number had risen to 63% (Canada Fitness Survey, 1982). By 1988, 75% of the males and 69% of the females 65 years of age and over were physically active (Stephens and Craig, 1990). The stated reasons for being physically active were "to feel better mentally and physically" (Canada Fitness Survey, 1982, p. 6). In fact, regular physical activity has been identified as one of the most important contributors to overall well-being of the older population (Stephens and Craig, 1990).

The Campbell's 1988 Survey on the Well-being of Canadians examined health and exercise habits of 4000 Canadians 10 years of age and over (Stephens and Craig, 1990). It reported that exercising at home and exercising alone becomes more common with age (Stephens and Craig, 1990). Amundsen, DeVahl and

Ellingham (1989) suggest that this is because exercising at home is convenient, inexpensive, and requires no special equipment. Environmental factors, such as inclement weather, transportation problems, and high crime areas, may also influence seniors to stay at home. A possible explanation for exercising alone may be that the types of activities chosen by older adults are usually individual activities such as walking, gardening and home exercise (Stephens and Craig, 1990).

The positive role of exercise on the physical fitness level of older adults has been well-documented (Blumenthal, Schocken, Needels and Hindle, 1982; Agre, Pierce, Raab, McAdams and Smith, 1988; Hagberg et al., 1989; Brown, McCartney and Sale, 1990). Significant gains in cardiovascular endurance (Adams and de Vries, 1973; Amundsen et al., 1989), muscular strength and endurance (Frontera, Meredith, O'Reilly, Knuttgen and Evans, 1988; Fiatrone, Marks, Ryan, Meredith, Lipsitz and Evans, 1990) and flexibility (Munns, 1981; Rabb, Agre, McAdams and Smith, 1988) using appropriate exercise programs have been well established.

The proposed relationship between physical and psychological well-being dates back to the ancient Greek concept of *mens sano in corpore sano* - a healthy mind in a healthy body. This holistic approach to well-being remains popular today (Hilyer and Mitchell, 1979, Parent and Whall, 1984; Millar, 1987). Research findings to date, however, have been equivocal regarding the relationship between physical

fitness and psychological well-being (Blumenthal et al., 1982; Valliant and Asu, 1985; Netz, Tenenbaum and Sagiv, 1988).

Some studies have shown no relationship between psychological well-being and physical fitness. Blumenthal et al. (1982) found small, nonsignificant psychological changes in adults 65 - 85 years of age after an 11 week conditioning program. Ford, Puckett, Blessing and Tucker (1989) reported no significant difference in psychological well-being between a control and an experimental group after an eight week physical activity program.

Other studies provide partial support for the relationship between physical fitness and psychological well-being. Folkins (1976) found two significant psychological well-being findings out of a possible five in men 40 - 58 years of age after a 12 week exercise program. Sidney and Shephard (1976) studied adults 65 years of age and over and reported an 83% improvement in their overall well-being after a 14 week physical training program; however, only one of the psychological variables was significant. There have also been studies which have found significant increases in "psychological fitness" in women but not in men (Folkins, Lynch and Gardner, 1972) and in men but not in woman (Netz et al., 1988).

A few studies have shown that positive psychological changes can occur through improved physical fitness. A significant increase ($p<.05$) in self-concept was reported for

seventh grade boys after an 18 week training program (McGowan, Jarman and Pedersen, 1974). Significant self-concept increases ($p<.05$) were found in co-ed college students after 10 weeks of physical fitness training (Hilyer and Mitchell, 1979). Positive psychological changes have also been noted in older adults. Parent and Whall (1984) found a positive correlation between self-esteem and physical activity in older individuals while Millar (1987) reported a significant decrease ($p<.02$) in depression in older individuals after three months of low intensity exercise.

Most studies to date regarding the relationship between physical fitness and psychological well-being have used prescribed exercise programs that have been monitored by exercise professionals and conducted in controlled exercise environments such as gymnasiums and fitness testing centres. No studies were found that utilized exercise programs which were self-prescribed and self-monitored.

PURPOSE

The purpose of this study was to investigate the effects of self-monitored, prescribed and self-prescribed exercise programs on the physical fitness and the psychological well-being of individuals 50 - 90 years of age.

RESEARCH QUESTIONS

1. Does prescribed, self-monitored physical exercise increase physical fitness levels as measured by cardiovascular endurance, muscular strength and endurance, and flexibility tests in older adults 50 - 90 years of age?
2. Does self-prescribed, self-monitored physical exercise increase physical fitness levels as measured by cardiovascular endurance, muscular strength and endurance, and flexibility tests in older adults 50 - 90 years of age?
3. Does prescribed, self-monitored physical exercise increase psychological well-being as measured by self-esteem, depression, personal control, symptoms of aging and social satisfaction tests in older adults 50 - 90 years of age?
4. Does self-prescribed, self-monitored physical exercise increase psychological well-being as measured by self-esteem, depression, personal control, symptoms of aging and social satisfaction tests in older adults 50 - 90 years of age?

OPERATIONAL DEFINITIONS

Physical Fitness: The ability of an individual to function efficiently and to perform physical activity. For the purposes of this study, physical fitness will include cardiovascular endurance, muscular strength and endurance, and flexibility measures (Bell, Collis and Hoshizaki, 1985).

Psychological Well-being: A mental state in which an individual feels good about themselves. For the purposes of this study, psychological well-being will include self-esteem, depression, personal control, symptoms of aging and social satisfaction measures (Linn and Linn, 1984).

Self-Monitored Exercise Program: A self-regulated exercise program in which an individual decides the frequency, intensity, duration and type of each exercise in the exercise program.

Self-Prescribed Exercise Program: An exercise program which is designed by an individual for him\herself.

Prescribed Exercise Program: An exercise program which is designed by the investigator for an individual.

LIMITATIONS

The study was limited by:

1. The subject's desire to become more physically fit regardless of which group they were in as well as their desire to please the investigator.
2. The accuracy and the thoroughness with which the subjects recorded the physical activity they utilized as exercise.
3. The health and personal problems of the subjects which were unrelated to the study.
4. The ability of the subjects to perform the exercises requested of them.
5. The ability of the subjects to design their own exercise program.

DELIMITATIONS

The study was delimited by:

1. The progressive training period for Group 3 subjects may not have been sufficient for improvements to develop. The total training time was nine weeks. However, subjects spent an unequal amount of time on each physical fitness component. They spent three weeks on cardiovascular endurance exercises, six weeks on muscular strength and endurance exercises, and nine weeks on suppleness exercises.
2. All subjects were 50 years of age and over.
3. All subjects were volunteers from the community.

METHOD

SUBJECTS

Volunteers from the Victoria area were solicited through the radio and newspaper. From approximately 500 initial contacts, 100 individuals (males=55; females=45) were selected through stratified randomization by age. That is, individuals were separated into four age groups (50-59, 60-69, 70-79, and 80+) before they were randomly assigned to one of the three groups. This was done to ensure homogeneity of ages throughout the three groups. Of the 100 individuals, 69 volunteered to participate.

A total of 12 subjects failed to complete the study. Reasons for dropping out included: medical (4), lack of interest (4), vacation (2), personal problems (1) and relocation (1). A total of 57 subjects (males=30; females=27) completed the study. The age of the subjects ranged from 50 to 88 years of age with an average age of 68.50 years (Table 1). Subjects were reasonably physically active at the start of the study as can be seen by Table 2 and Table 3.

Table 1. Physical Characteristics of Subjects

VARIABLE	GROUP	SEX	n	X	sd	RANGE
AGE (years)	1	M	12	71.17	11.00	52-85
		F	10	63.40	15.72	50-78
	2	M	9	64.11	7.25	53-75
		F	9	71.00	11.18	54-88
	3	M	9	65.63	8.78	54-79
		F	8	74.63	11.16	59-88
WEIGHT (kg)	1	M	12	76.35	9.88	56-98
		F	10	72.95	15.72	48-99
	2	M	9	81.77	9.35	70-96
		F	9	64.37	9.29	51-81
	3	M	9	74.75	10.03	66-93
		F	8	65.17	12.23	51-88
HEIGHT (cm)	1	M	12	174.10	11.80	162-193
		F	10	165.00	8.60	150-175
	2	M	9	174.10	11.50	160-191
		F	9	162.70	7.50	149-172
	3	M	9	172.10	8.20	160-183
		F	8	160.70	4.50	154-167

Table 2. Subject Profile on Strength and Cardiovascular Endurance Participation Prior to the Study*

VARIABLE	GROUP 1				GROUP 2				GROUP 3			
	MALES		FEMALES		MALES		FEMALES		MALES		FEMALES	
	X	sd	X	sd	X	sd	X	sd	X	sd	X	sd
HOURS ON STRENGTH EX. PER WEEK	1.83	2.24	1.50	1.90	1.75	2.05	1.40	1.89	1.90	1.79	0.57	0.78
WEEKS ON STRENGTH EX. PER YEAR	26.00	24.79	18.10	17.50	25.87	24.07	23.40	22.76	29.90	20.88	14.86	20.46
HOURS ON CARDIOVASC. PER WEEK	6.58	3.80	5.10	3.10	6.25	2.76	5.40	2.36	7.90	6.95	3.70	3.30
WEEKS ON CARDIOVASC. PER YEAR	41.17	17.30	38.80	21.97	48.75	9.19	45.90	10.71	43.80	17.37	33.14	24.49

* The Activity Appraisal Questionnaire was not designed to address flexibility; therefore, there were no reports of participation in flexibility exercises.

Table 3. Subject Activity Profile of the *Most Popular Physical Activities Performed Prior to the Study

VARIABLE	GROUP 1				GROUP 2				GROUP 3			
	MALES		FEMALES		MALES		FEMALES		MALES		FEMALES	
	X	sd	X	sd	X	sd	X	sd	X	sd	X	sd
HOURS WALKED PER WEEK	4.25	3.04	4.10	3.10	4.12	2.43	7.60	6.74	4.60	3.10	2.85	3.18
WEEKS WALKED PER YEAR	33.92	19.70	27.10	17.60	41.26	17.90	40.70	17.74	37.60	17.65	22.57	23.14
HOURS SWAM PER WEEK	1.25	2.30	0.60	0.96	1.12	1.35	0.20	0.63	1.10	2.51	0.57	1.13
WEEKS SWAM PER YEAR	11.57	20.34	9.30	12.32	5.37	8.93	2.60	8.22	10.00	17.17	7.29	12.45
HOURS BIKED PER WEEK	1.08	2.11	0.40	0.69	1.00	1.30	0.20	0.31	2.20	3.15	0.28	0.48
WEEKS BIKED PER YEAR	11.67	20.34	7.70	12.40	12.50	19.03	4.10	8.58	19.40	20.33	4.28	9.69

* Most popular physical activities was defined as having at least 30% (n=17) of all subjects participating in each physical activity category. Four physical activities fit into this criteria including strength exercises from Table 2.

PRE-TEST PROTOCOL

Subjects were mailed three forms which they were required to complete prior to the first session. The forms were an Informed Consent Form, a Physical Activity Readiness Questionnaire (PAR-Q), and an Activity Appraisal Questionnaire.

The Informed Consent Form advised the subjects of the procedures and risks of the study. It also indicated that a subject's participation was completely voluntary and that a subject could discontinue at any time during the study (Appendix B).

The PAR-Q was used to identify those individuals for whom regular physical activity might pose a health risk. Those subjects who answered YES to any question on the PAR-Q were asked to phone the investigator. These potential risk subjects were required to obtain a medical clearance before they were allowed to participate in the study (Appendix B). The investigator sent each of these potential risk subjects a "Dear Doctor" Form which was a letter addressed to the subject's physician. It outlined the protocol of the study and requested a medical clearance for the subject to participate in the study (Appendix C).

The Activity Appraisal Questionnaire was designed to collect descriptive information about the physical activity habits of the subjects prior to the study (Appendix D).

TEST PROTOCOL

The test team was trained to acceptable levels to administer the Post 50 Physical Performance Test. Reliability figures of the Post 50 Test ranged from .75 to .85.

All subjects met at the University of Victoria twice; once at the beginning and once at the end of the nine week study to undergo physical fitness and psychological well-being assessments. During both test sessions, subjects were scheduled in groups of three at 40 minute intervals between the hours of 8:30 am and 4:30 pm. Every attempt was made to post-test subjects at the same time as their pre-test session. Most of the subjects were tested at the same time for both the pre-test and the post-test sessions.

Upon arrival at the first session, subjects were welcomed and their pre-test forms were collected. Test team members checked to ensure that all forms were complete including medical approval for those subjects who required it. Subjects were then informed of the general procedures of the day. They were informed that they would begin the session by completing a written questionnaire called the Self-Evaluation of Life Function (SELF) Scale. A five minute warm-up would then follow before performing the Post 50 "3-S" Physical Performance Test.

The SELF Scale is a short, comprehensive written test for assessing overall psychological well-being in older adults

(Appendix E). This 41 item questionnaire was developed specifically for older adults and measures five aspects of psychological well-being: self-esteem, depression, personal control, symptoms of aging, social satisfaction (Linn and Linn, 1984).

The SELF Scale was derived from eight existing scales in the areas of self-esteem (Brown, 1961; Rosenberg, 1965; Coopersmith, 1967), depression (Derogatis, Lipman, Rickels, Uhlenhuth, and Covi, 1974), personal control (Reid, Hass, and Hawkings, 1977; Rotter, 1966), symptoms of aging (Katz, Ford, Moskowitz, Jackson, and Jaffe, 1963), and social satisfaction (Linn, Sculthorpe, Evje, Slater, and Goodman, 1969). Predictive validity was tested for using self-assessed health as the criterion (Linn and Linn, 1984). All five factors significantly correlated with self-assessed health ($p<.01$). Reliability of intraclass correlations on the five factors was .93 to .59 (Linn and Linn, 1984) which compared well with reliability figures of the eight scales from which the SELF Scale was developed. The reliability figures of the eight scales ranged from .95 to .50. Because the SELF Scale is multidimensional, it is limited to providing a general assessment of an individual's psychological well-being.

Subjects were informed that the SELF Scale was a multiple choice questionnaire, four pages long, and that all information received from it would remain confidential. They were told to follow the instructions on each page and complete

it at their own pace. Once they completed the SELF Scale they handed it in to a test team member and moved to the next station to begin their warm-up.

The warm-up for the Post 50 Physical Performance Test consisted of a series of exercises which took about five minutes to complete (Appendix F). The warm-up was lead by one of the test team members. The warm-up was designed to prepare the body for physical activity by limbering up muscles and joints. Subjects were told breathe at all times, to hold the stretches and to go at their own pace. Once the subjects finished the warm-up they began the *Post 50 Physical Performance Test*.

The *Post 50 Physical Performance Test* is a home-based test used for assessing overall physical fitness in older adults (Appendix G). The test was designed specifically for individuals over 50 years of age and measures three aspects of physical fitness: cardiovascular endurance, muscular strength and endurance and flexibility. Normally the test is self-administered, however, for the purpose of this study the test was administered by the test team. The Post 50 Test was found to be a valid and reliable tool (Bell, Collis and Hoshizaki, 1985). Reliability of the fitness measures ranged from .81 to .91 with no significant ($p<.05$) dependent t-values between tests (Bell, Collis and Hoshizaki, 1985).

Subjects were informed that the Post 50 Test was being used to measure their physical fitness. They were told that

it consisted of seven test items all of which were individually explained and demonstrated to them at this time. Subjects were cautioned to keep breathing at all times during the different test items, to remain at comfort zone intensity and to stop if they felt uncomfortable.

INTERVENTION

After subjects completed the tests, they were individually informed as to which group they had been assigned. Three groups were created: one control and two experimental groups. Subjects assigned to Group 1 (control group) were asked not to increase or change their present level of physical activity over the nine week period.

Subjects assigned to Group 2 were asked to participate in a self-prescribed, self-monitored exercise program. They were given a copy of the book *Recipes for Fitness after 50: Personalized Exercise Programs (PEP!)* at the end of the pre-test session. *Recipes for Fitness after 50: Personalized Exercise Programs (PEP!)* is an exercise book which was written specifically for the post 50 generation. It features instructions and strategies for self-programming and self-monitoring exercise (Bell, 1991). It was designed to educate the user about exercise and to assist the user in creating a personalized exercise program. Subjects were asked to use this book to design their own exercise program to be used over the nine week experimental period. They were given no directions on how to develop or what to include in the

exercise program.

Subjects assigned to Group 3 were asked to participate in a prescribed, self-monitored exercise program of cardiovascular endurance, muscular strength and endurance and flexibility. The prescribed exercise programs were selected by the investigator from *Recipes for Fitness after 50: Personalized Exercise Programs (PEP!)*. Subjects were asked to perform a daily, general flexibility program of 12 stretches for the first three weeks of the study (Appendix H). At the end of the first three weeks, subjects in Group 3 received a letter in the mail which gave instructions for the next part of their exercise program.

For the second three weeks, subjects were asked to continue with the flexibility program and add an upper body strength program. The upper body strength program consisted of five exercises to be performed twice a week with two days of rest in between (Appendix I). At the end of the second three weeks, subjects in Group 3 received another letter in the mail which gave instructions for the final part of their exercise program.

The third three weeks, subjects were asked to continue their flexibility and muscular strength and endurance exercises and to add a cardiovascular endurance program. The cardiovascular endurance program consisted of a 25 minute brisk walk, 3 times a week (Appendix J). This particular progression of exercises was chosen in order to help prevent

injury and exercise overload. This progression allowed the subjects to establish a balanced exercise program gradually. Subjects were given no information as to what subjects in other groups were requested to do.

Subjects in all groups were asked to keep an Activity Log throughout the nine weeks (Appendix K). All subjects were given instructions and shown how to fill out the Activity Log after they had been assigned to a group. The Activity Log was a form on which the subjects recorded the type and duration of any physical activity that they participated in for the purpose of exercise during the study.

All subjects were encouraged to complete the study through regular communication with the investigator. Subjects were sent a letter every three weeks for the purposes of: "touching base" with the subjects, reminding them to keep using their activity logs to record exercise efforts and sending them extra copies of the Activity Log. The letters also served to remind subjects in Group 2 to continue with their self-prescribed exercise program and to send subjects in Group 3 their next exercise program.

DATA ANALYSIS

A multivariate analysis of variance (MANOVA) was used to analyze pre-test physical fitness and psychological well-being measures. Since no significant ($p<.05$) differences were found, a MANOVA was used to analyze post-test data.

Significant findings resulting from the MANOVA on the post-test measures were followed by post hoc paired comparisons. To control for an inflated alpha error, Scheffe was used for post hoc paired comparison analyses. The level of significance was set at $p<.05$.

The Activity Logs were analyzed based on three criteria. The first criterion was the type of physical activity such as cardiovascular endurance, muscular strength and endurance or flexibility exercises. The second criterion used to analyze the Activity Logs was the amount of time (minutes/hours) that was spent on a particular physical activity. The third criterion was the number of weeks the subjects spent on a particular physical activity over the nine week period. A MANOVA was then used to analyze the information contained in the Activity Logs. Significant findings were further analyzed using univariate analysis of variance (ANOVA) and Scheffe.

RESULTS

Results from the MANOVA showed that there was a significant ($p<.05$) time effect and a significant ($p<.05$) sex effect but no group effect on the physical fitness and psychological well-being measures (Table 4). That is, there were no significant ($p<.05$) differences between groups on any of the physical fitness scores or psychological well-being scores. However, there were significant ($p<.05$) differences within the groups and by sex.

Research Question #1

Does prescribed, self-monitored physical exercise increase physical fitness levels as measured by cardiovascular endurance, muscular strength and endurance, and flexibility tests in older adults 50 - 90 years of age?

The results of this study offer some support for the thesis that prescribed, self-monitored physical exercise can increase some physical fitness levels (see Figures 1 - 9). Males in Group 3 which participated in prescribed, self-monitored physical exercise increased in eight out of nine physical fitness measures of which one was statistically significant. Group 3 males were able to perform significantly ($p<.01$) more Modified Push-Ups after the nine week exercise intervention (pre X=21.86, post X=29.30) (Table 5). The physical fitness measure in which they did not increase was the Right Shoulder Flexion which actually showed a small

Table 4. MANOVA Results of the Physical Fitness and Psychological Well-being Measures

EFFECT	MULTIVARIATE F	p
Group	0.819	0.701
Time	5.300	0.001
Sex	2.715	0.010
Group by Time	0.691	0.844
Group by Sex	0.880	0.646
Sex by Time	0.587	0.868
Group by Sex by Time	1.092	0.377

Table 5. Mean Pre-test and Post-test Physical Fitness and Psychological Well-being Scores for Group 3

PHYSICAL FITNESS	SEX	PRE X	POST X	t	SIG. LEVEL
TWO MINUTE ON-THE-SPOT WALK	M	85.50	90.13	0.52	NS
	F	78.88	90.25	3.11	.01
400 METRE WALK	M	232.88	221.25	2.10	NS
	F	284.63	283.13	0.36	NS
CURL-UPS	M	30.57	36.00	1.58	NS
	F	19.13	21.75	0.97	NS
MODIFIED PUSH-UPS	M	21.86	29.30	3.88	.01
	F	12.50	14.88	1.16	NS
* SIT AND REACH	M	2.57	2.86	0.44	NS
	F	3.25	3.75	1.87	NS
RIGHT SHOULDER FLEXION	M	5.00	4.88	1.00	NS
	F	4.13	4.50	2.05	NS
LEFT SHOULDER FLEXION	M	4.50	4.63	1.00	NS
	F	3.88	4.00	0.55	NS
RIGHT TRUNK LATERAL FLEXION	M	3.50	3.64	0.31	NS
	F	3.13	3.13	0.00	NS
LEFT TRUNK LATERAL FLEXION	M	3.13	3.25	0.42	NS
	F	2.75	2.88	1.00	NS
**SELF-ESTEEM (Scale 7-28)	M	12.38	13.00	1.36	NS
	F	13.63	13.25	0.50	NS
DEPRESSION (Scale 11-44)	M	18.38	19.38	1.67	NS
	F	19.13	19.63	0.49	NS
SYMPTOMS OF AGING (Scale 11-44)	M	14.25	13.63	0.71	NS
	F	17.75	17.38	0.32	NS
SOCIAL SATISFACTION (Scale 6-24)	M	10.88	10.25	0.86	NS
	F	10.25	9.50	1.34	NS
PERSONAL CONTROL (Scale 4-16)	M	8.75	8.75	0.00	NS
	F	9.00	9.50	1.08	NS

* All flexibility measures range from 1 (low) to 5 (high).
** For the psychological measures a low score is positive, while high score is negative.

decrease (pre X=5.00, post X=4.88). Similarly, Group 3 females increased in eight out of nine physical fitness measures of which one was statistically significant. Females in Group 3 improved significantly ($p<.01$) in the Two Minute On-the-Spot Walk after the nine week intervention (pre X=78.88, post X=90.25). The physical fitness measure in which they did not increase was Right Lateral Flexion which stayed the same over the nine week period.

Research Question #2

Does self-prescribed, self-monitored physical exercise increase physical fitness levels as measured by cardiovascular endurance, muscular strength and endurance, and flexibility tests in older adults 50 - 90 years of age?

The results of this study offer limited evidence to support the thesis that self-prescribed, self-monitored physical exercise can increase some physical fitness levels. In Group 2, males increased in six of the nine physical fitness measures. However, none of these improvements were statistically significant ($p<.05$) (Table 6). They stayed the same for the Sit and Reach and Right Shoulder Flexion but decreased slightly in Left Shoulder Flexion (pre X=4.33, post X=4.22). Group 2 females increased in seven of the nine physical fitness measures of which three were statistically significant. Group 2 females were significantly more flexible

Table 6. Mean Pre-test and Post-test Physical Fitness and Psychological Well-being Scores for Group 2

PHYSICAL FITNESS	SEX	PRE X	POST X	t	SIG. LEVEL
TWO MINUTE ON-THE-SPOT WALK	M	93.22	98.00	1.53	NS
	F	83.90	86.30	0.82	NS
400 METRE WALK	M	230.89	227.42	0.33	NS
	F	268.80	253.30	0.82	NS
CURL-UPS	M	27.22	34.33	1.66	NS
	F	18.90	25.80	3.68	.01
MODIFIED PUSH-UPS	M	25.25	28.50	2.00	NS
	F	14.29	20.57	3.50	.01
* SIT AND REACH	M	2.88	2.88	0.00	NS
	F	2.60	3.20	2.71	.05
RIGHT SHOULDER FLEXION	M	4.33	4.33	0.00	NS
	F	3.80	4.00	1.00	NS
LEFT SHOULDER FLEXION	M	4.33	4.22	0.55	NS
	F	3.90	3.90	0.00	NS
RIGHT TRUNK LATERAL FLEXION	M	3.13	3.63	0.88	NS
	F	2.30	2.30	0.00	NS
LEFT TRUNK LATERAL FLEXION	M	3.25	3.63	0.53	NS
	F	1.90	2.00	0.32	NS
**SELF-ESTEEM (Scale 7-28)	M	14.78	14.56	0.80	NS
	F	13.70	12.50	2.71	.05
DEPRESSION (Scale 11-44)	M	20.11	19.11	0.82	NS
	F	18.30	18.30	0.00	NS
SYMPTOMS OF AGING (Scale 11-44)	M	16.00	17.11	0.92	NS
	F	15.40	16.50	1.02	NS
SOCIAL SATISFACTION (Scale 6-24)	M	11.78	11.89	0.13	NS
	F	9.90	9.20	1.77	NS
PERSONAL CONTROL (Scale 4-16)	M	8.67	8.78	0.17	NS
	F	7.30	6.80	0.73	NS

* All flexibility measures range from 1 (low) to 5 (high).
** For the psychological measures a low score is positive, while high score is negative.

($p<.05$) as measured by the Sit and Reach test (pre X=2.60, post X=3.20). They also improved significantly in both muscular strength and endurance tests. They improved the number of Modified Push-Ups ($p<.01$) performed (pre X=14.29, post X=20.57) and number of Curl-Ups ($p<.01$) performed (pre X=18.90, post X=25.80). They experienced no change in Left Shoulder Flexion or Right Lateral Flexion.

The Control Group (Group 1) also increased in some of the physical fitness measurements. Males in the Control Group increased on six of the nine physical fitness items of which three were statistically significant. They showed significant improvement ($p<.01$) in the Two Minute On-the-Spot Walk (pre X=82.33; post X=94.42) (Table 7). They also improved significantly in both muscular strength and endurance measures. They could perform significantly more push-ups ($p<.05$) (pre X=18.58; post X=22.42) and curl-ups ($p<.01$) (pre X=21.75; post X=28.83). Control Group males showed a slight decrease in the 400 Metre Walk, Right Shoulder Flexion and Right Lateral Flexion.

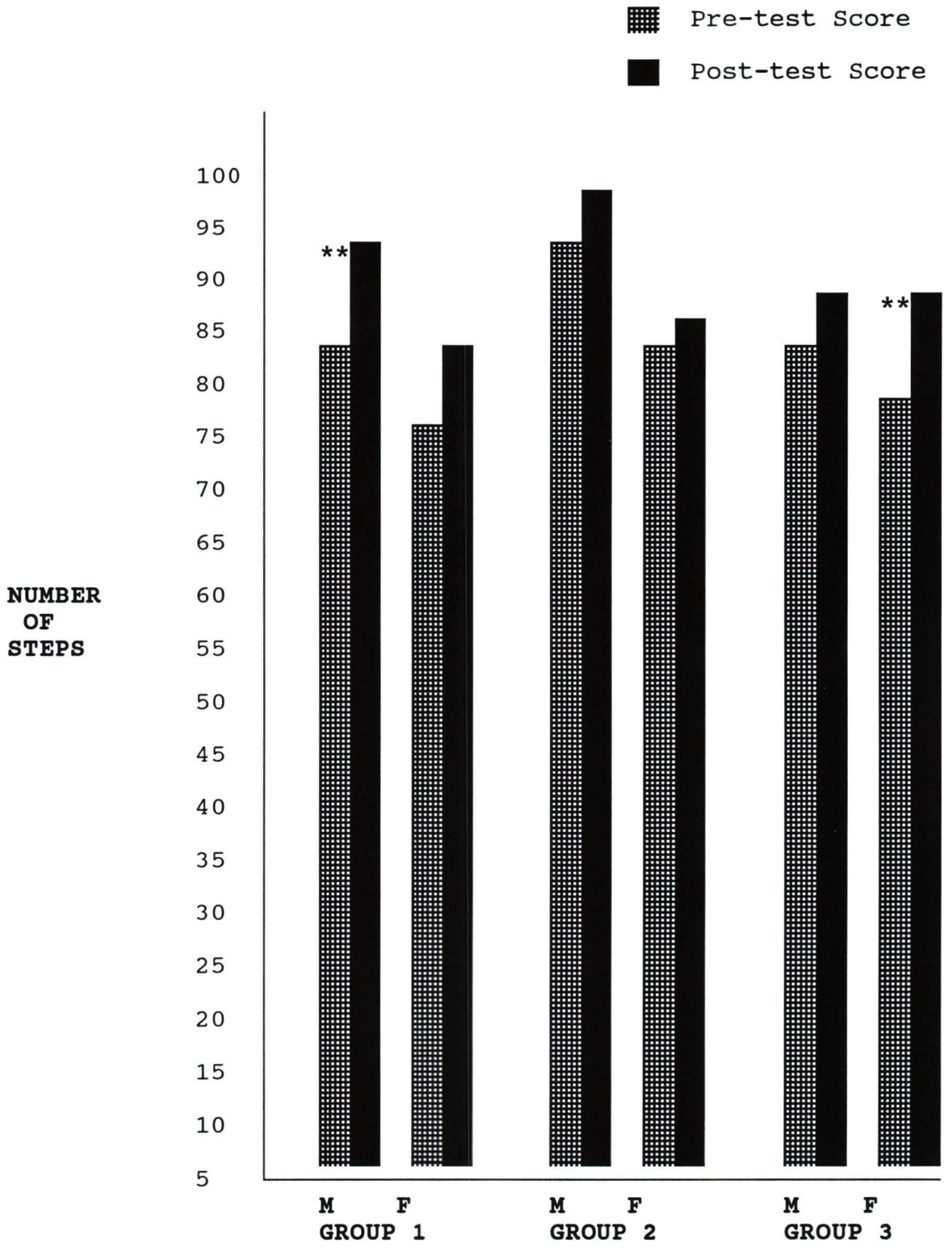
Control Group females increased in five of the nine physical fitness items of which one of these measures was significant. They were able to perform significantly more ($p<.01$) push-ups (pre X=11.56; post X=18). Females in the Control Group stayed the same for Left Shoulder Flexion but showed a slight decrease in the 400 Metre Walk, Right Shoulder Flexion and Left Lateral Flexion.

Table 7. Mean Pre-test and Post-test Physical Fitness and Psychological Well-being Scores for Group 1

PHYSICAL FITNESS	SEX	PRE X	POST X	t	SIG. LEVEL
TWO MINUTE ON-THE-SPOT WALK	M	82.33	94.42	2.77	.01
	F	75.56	84.78	1.53	NS
400 METRE WALK	M	248.08	249.42	0.33	NS
	F	264.22	264.88	0.10	NS
CURL-UPS	M	21.75	28.83	3.98	.01
	F	19.00	24.44	2.17	NS
MODIFIED PUSH-UPS	M	18.58	22.42	2.48	.05
	F	11.56	18.00	4.17	.01
* SIT AND REACH	M	2.33	2.58	1.39	NS
	F	2.67	3.00	1.15	NS
RIGHT SHOULDER FLEXION	M	4.43	4.25	0.43	NS
	F	4.60	4.50	0.56	NS
LEFT SHOULDER FLEXION	M	4.17	4.25	0.43	NS
	F	4.50	4.50	0.00	NS
RIGHT TRUNK LATERAL FLEXION	M	2.58	2.30	0.76	NS
	F	2.78	3.00	0.55	NS
LEFT TRUNK LATERAL FLEXION	M	2.17	2.33	0.52	NS
	F	2.89	2.78	0.32	NS
**SELF-ESTEEM (Scale 7-28)	M	13.92	13.67	0.42	NS
	F	12.40	12.70	0.76	NS
DEPRESSION (Scale 11-44)	M	19.58	17.58	2.00	NS
	F	18.50	17.90	0.97	NS
SYMPTOMS OF AGING (Scale 11-44)	M	15.67	15.42	0.30	NS
	F	14.50	14.30	0.21	NS
SOCIAL SATISFACTION (Scale 6-24)	M	10.59	10.50	0.16	NS
	F	9.90	9.50	0.18	NS
PERSONAL CONTROL (Scale 4-16)	M	8.33	9.00	1.30	NS
	F	8.00	7.80	0.56	NS

* All flexibility measures range from 1 (low) to 5 (high).
** For the psychological measures a low score is positive, while high score is negative.

Figure 1. Pre-test and Post-test Scores for Two Minute On-the-Spot Walk for Group 1, Group 2, and Group 3



** p<.01

Figure 2. Pre-test and Post-test Scores for 400 Metre Walk for Group 1, Group 2, and Group 3

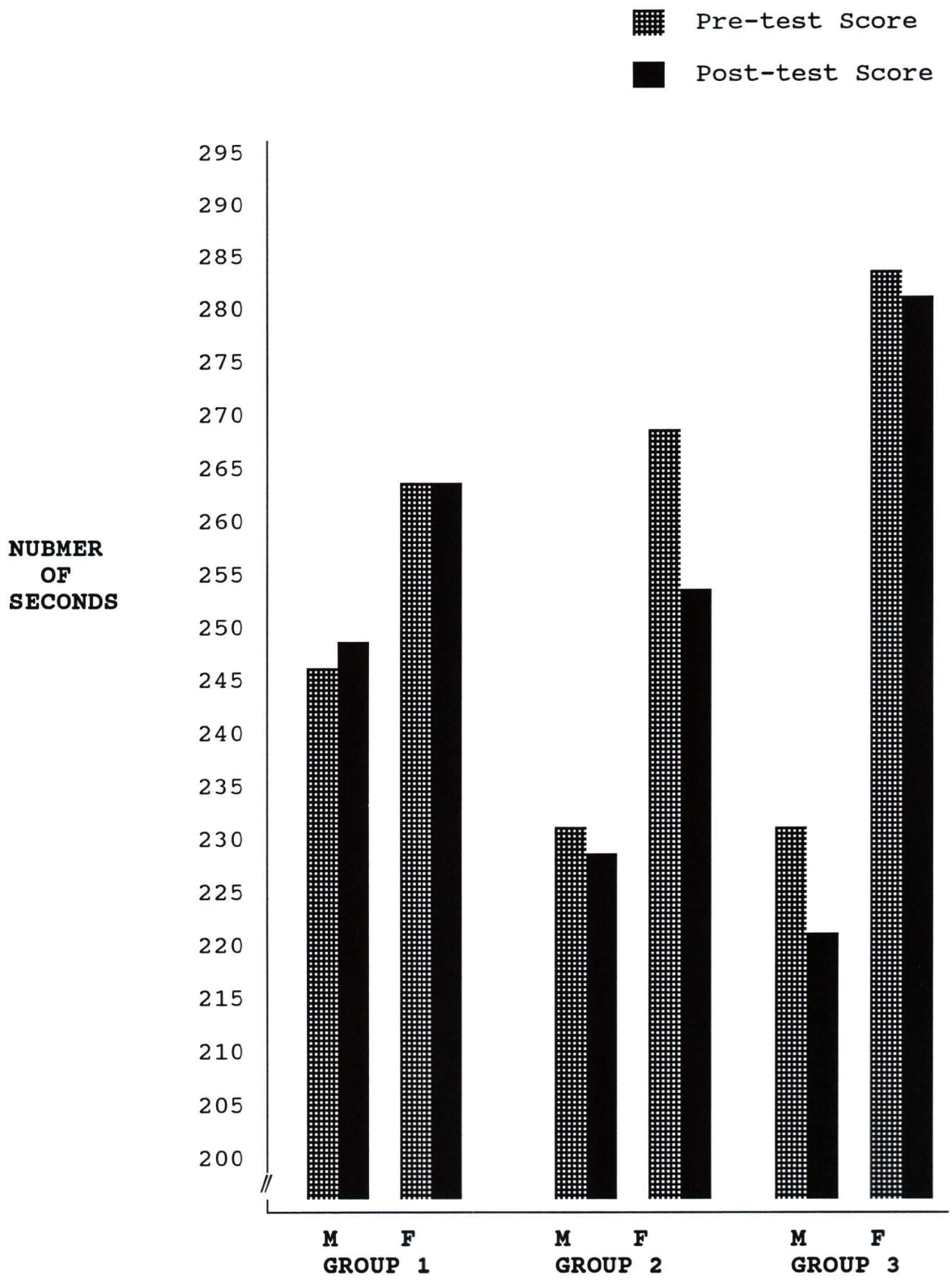


Figure 2. Pre-test and Post-test Scores for 400 Metre Walk for Group 1, Group 2, and Group 3

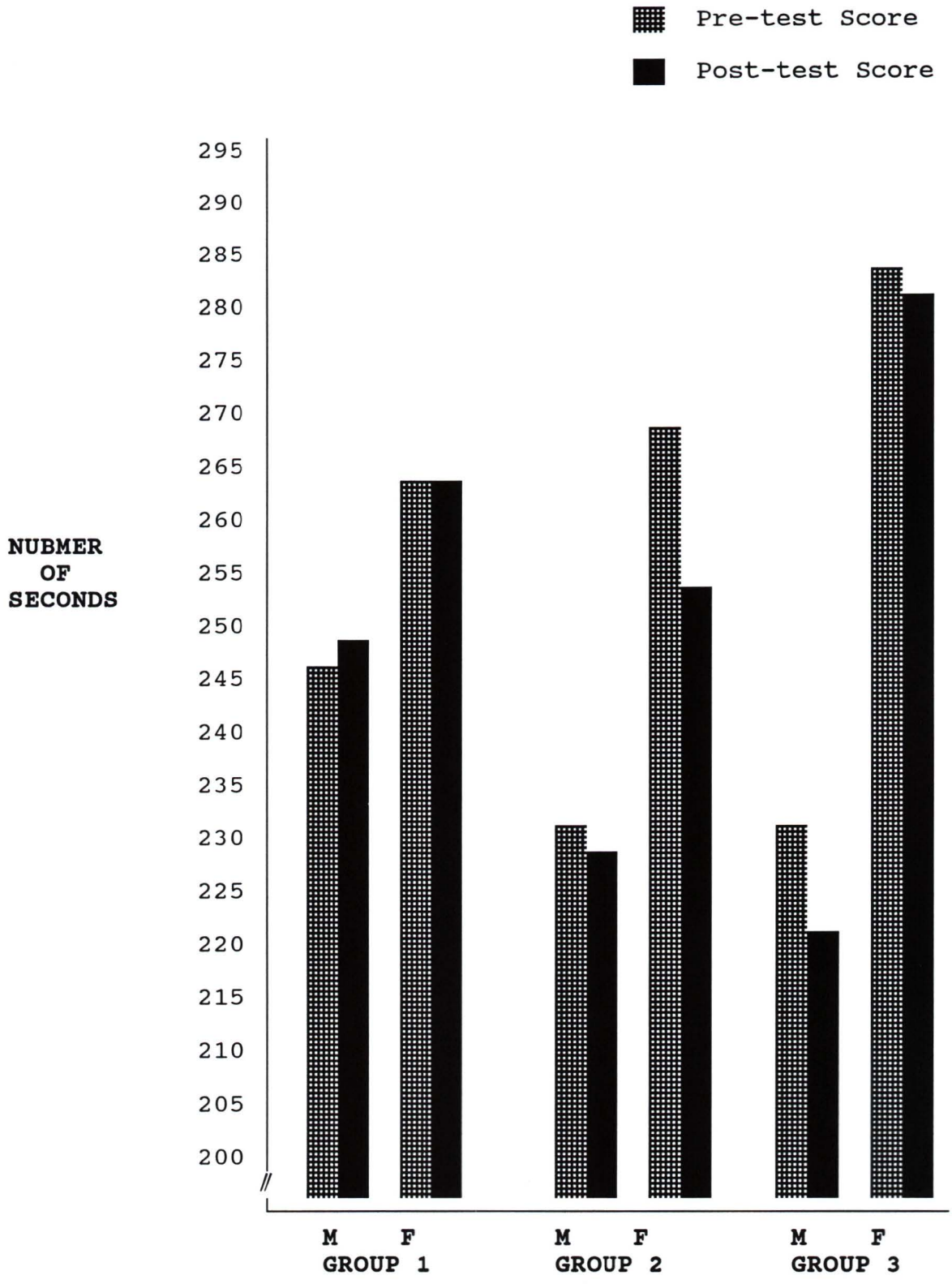
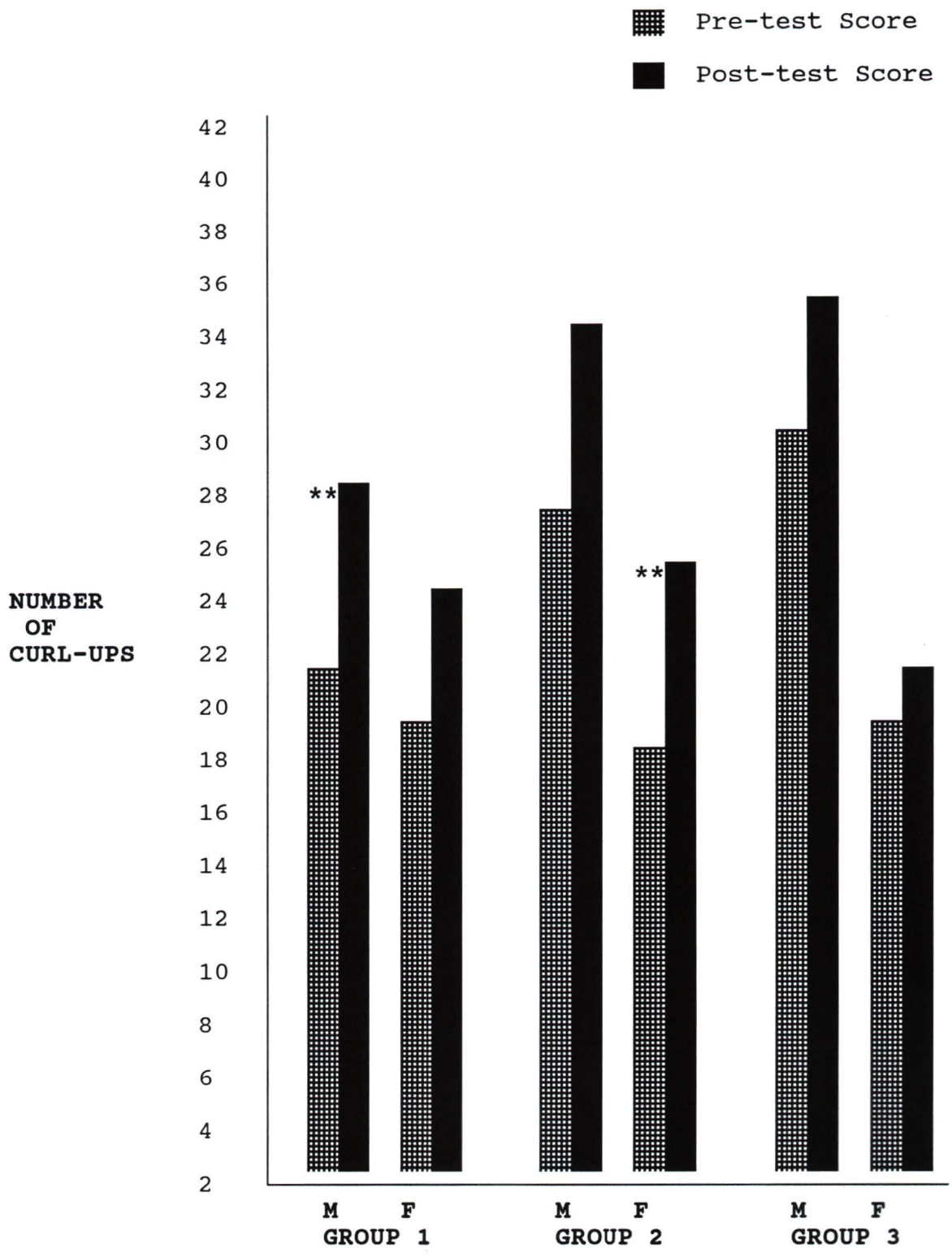
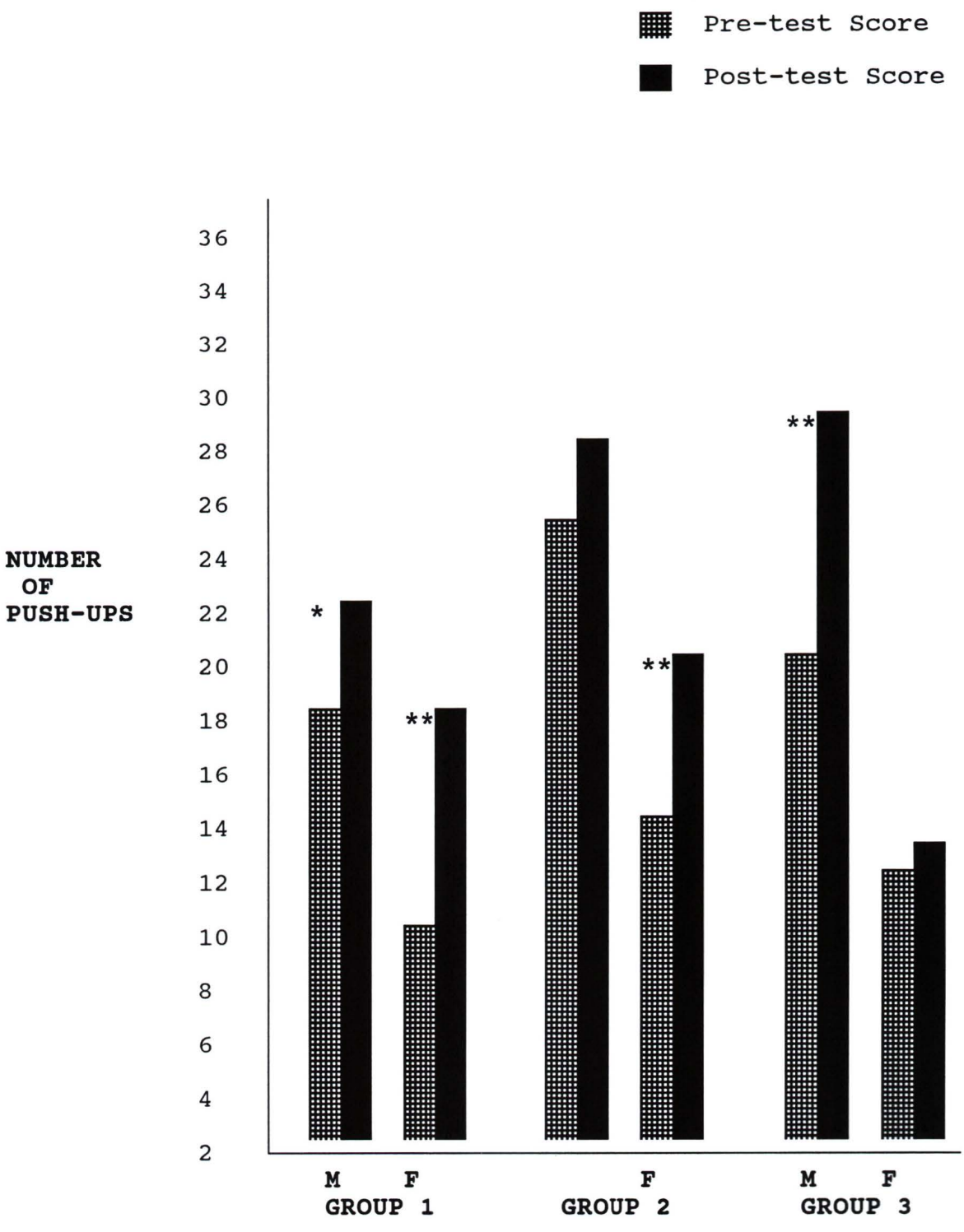


Figure 3. Pre-test and Post-test Scores for Curl-Ups for Group 1, Group 2, and Group 3



** p<.01

Figure 4. Pre-test and Post-test Scores for Push-Ups for Group 1, Group 2, and Group 3



* p<.05
** p<.01

Figure 5. Pre-test and Post-test Scores for Sit and Reach for Group 1, Group 2, and Group 3

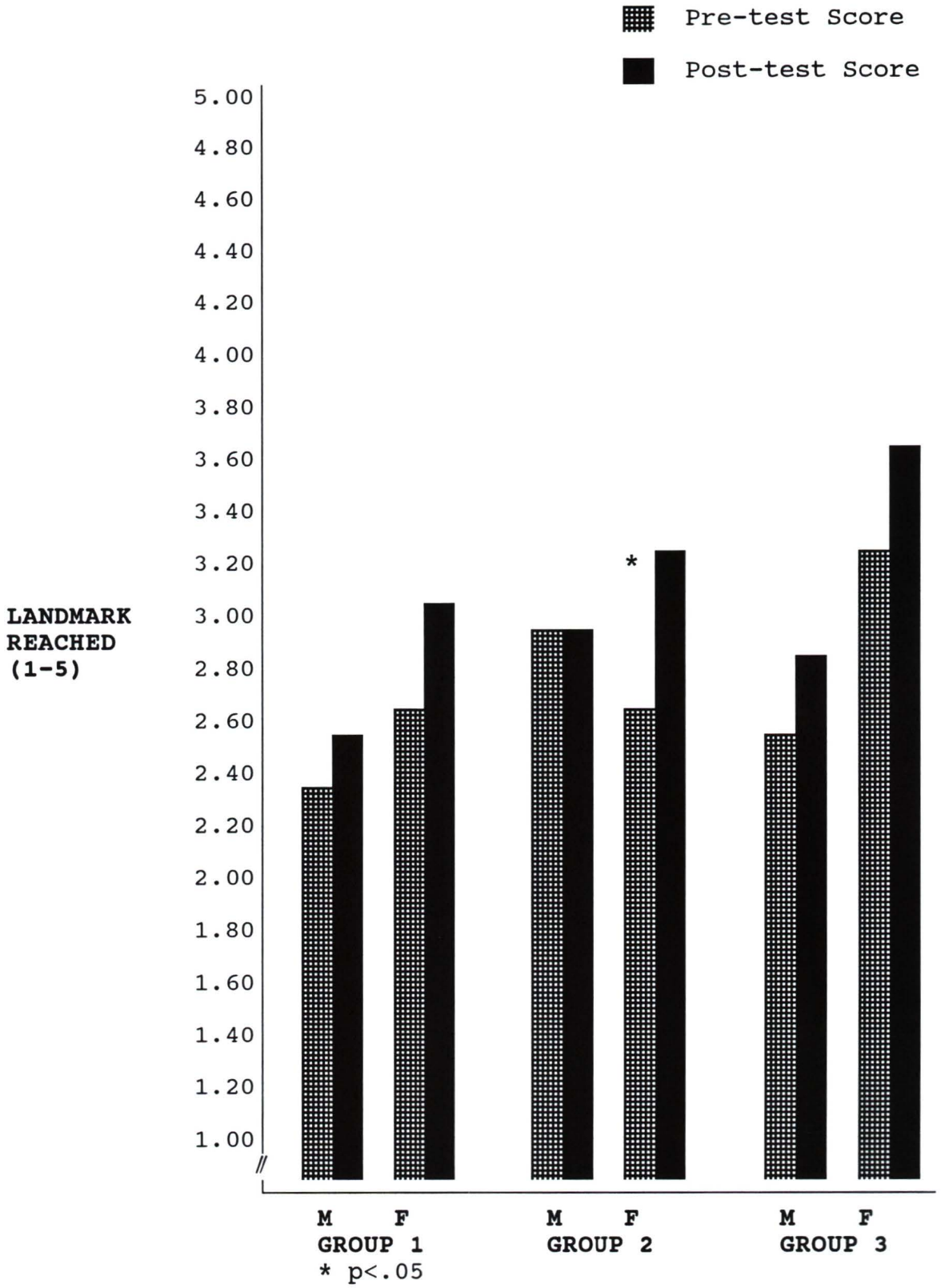


Figure 6. Pre-test and Post-test Scores for Right Shoulder Flexion for Group 1, Group 2, and Group 3

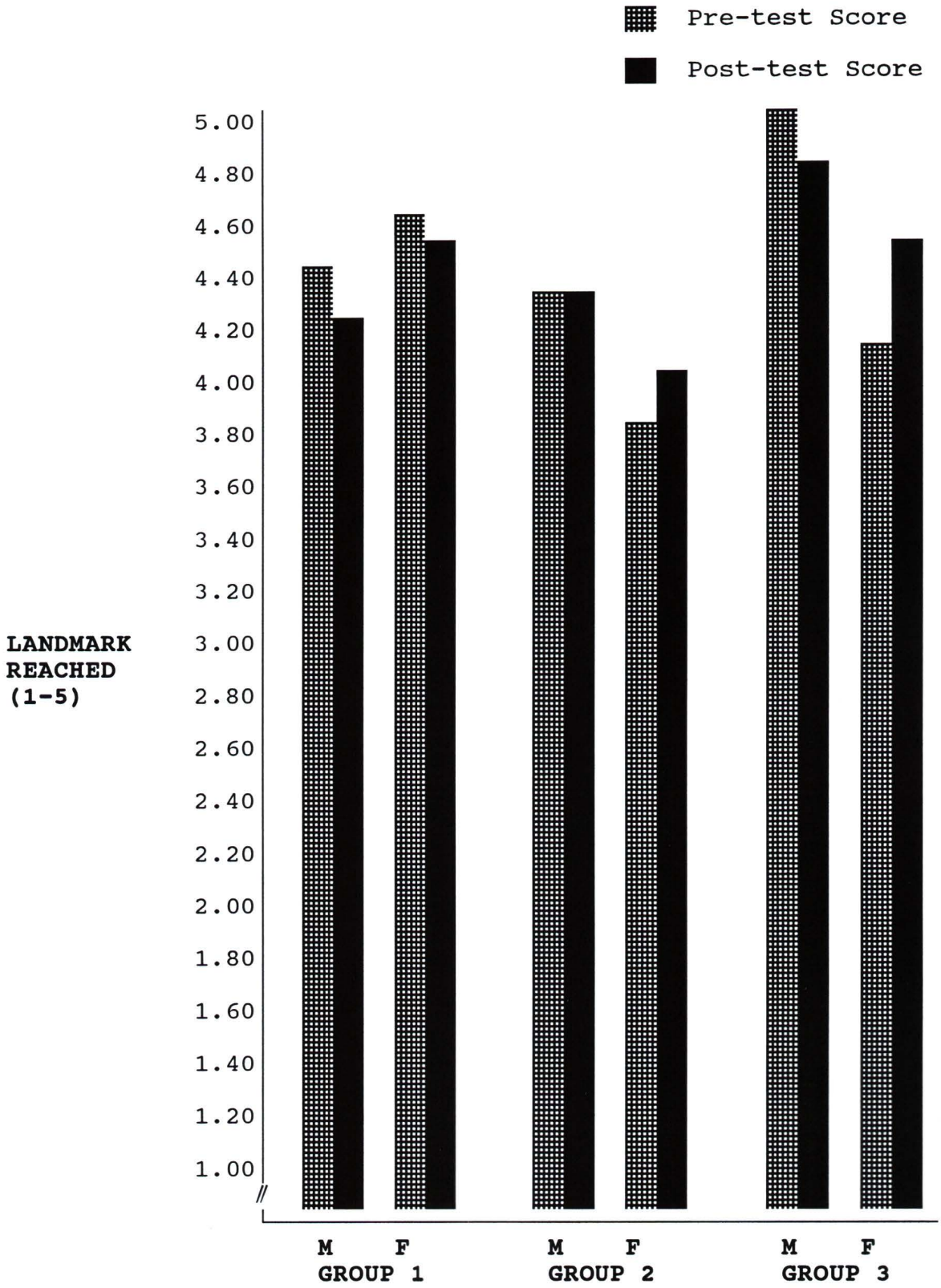


Figure 7. Pre-test and Post-test Scores for Left Shoulder Flexion for Group 1, Group 2, and Group 3

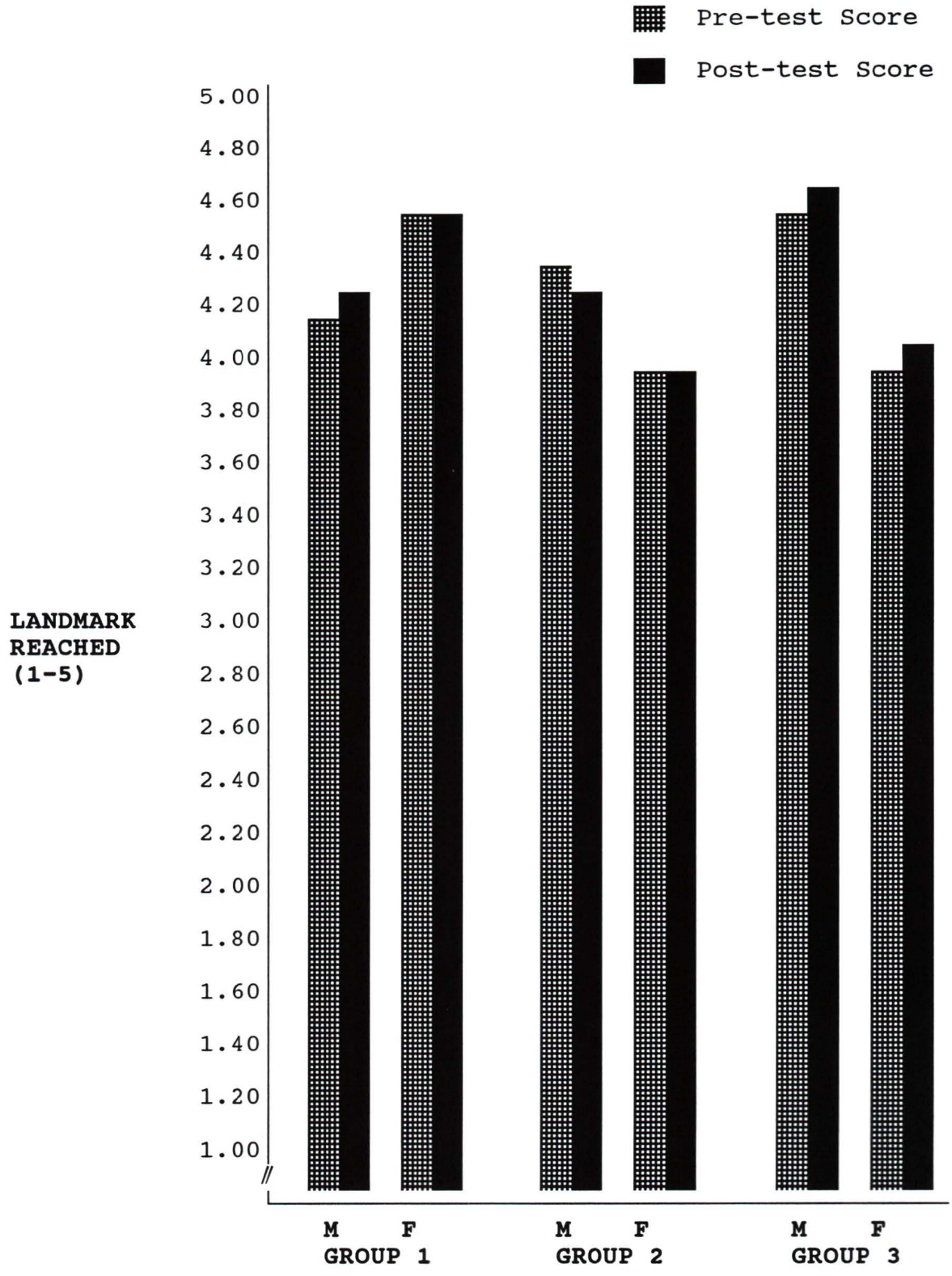


Figure 8. Pre-test and Post-test Scores for Right Trunk Lateral Flexion for Group 1, Group 2, and Group 3

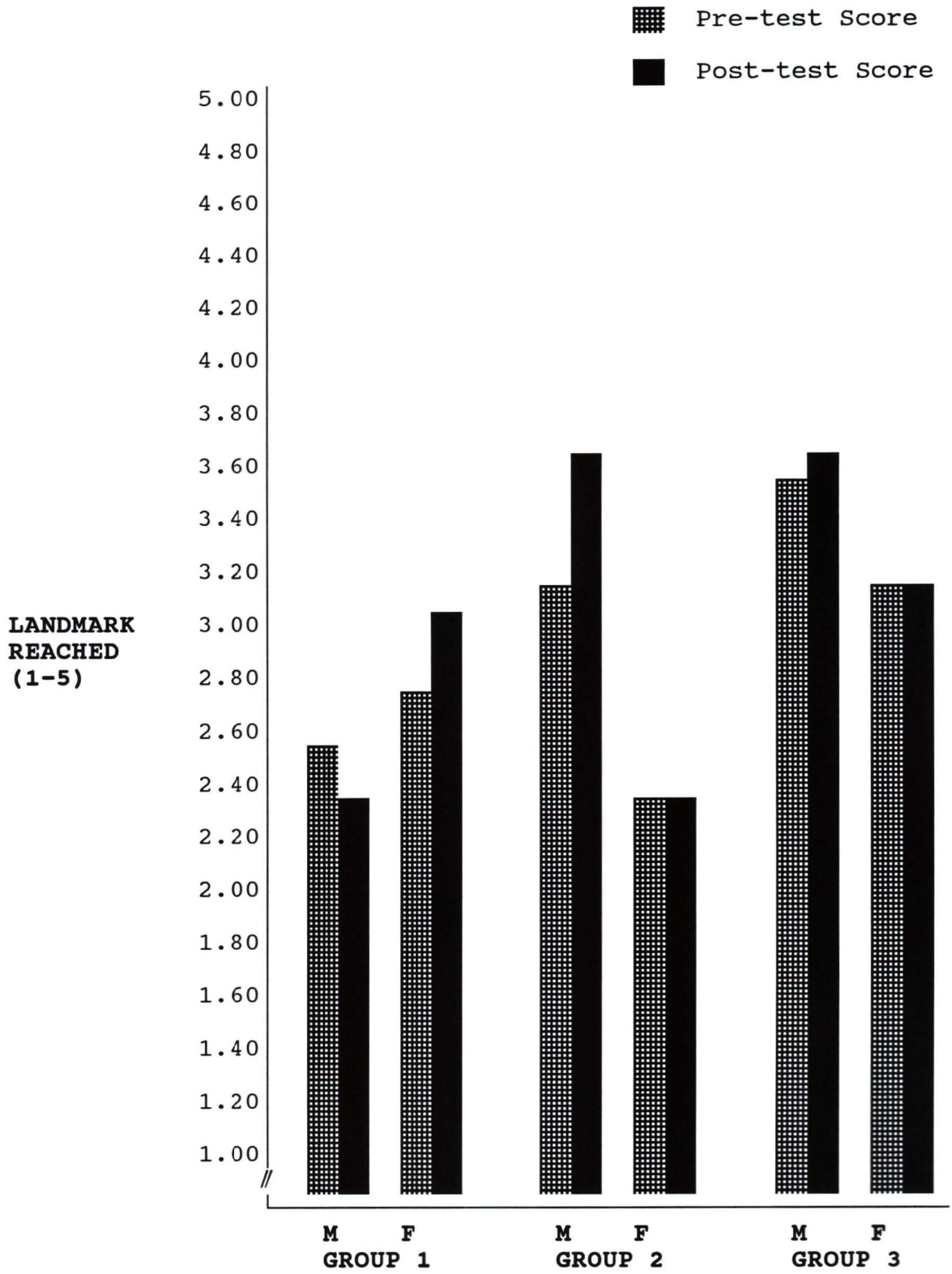
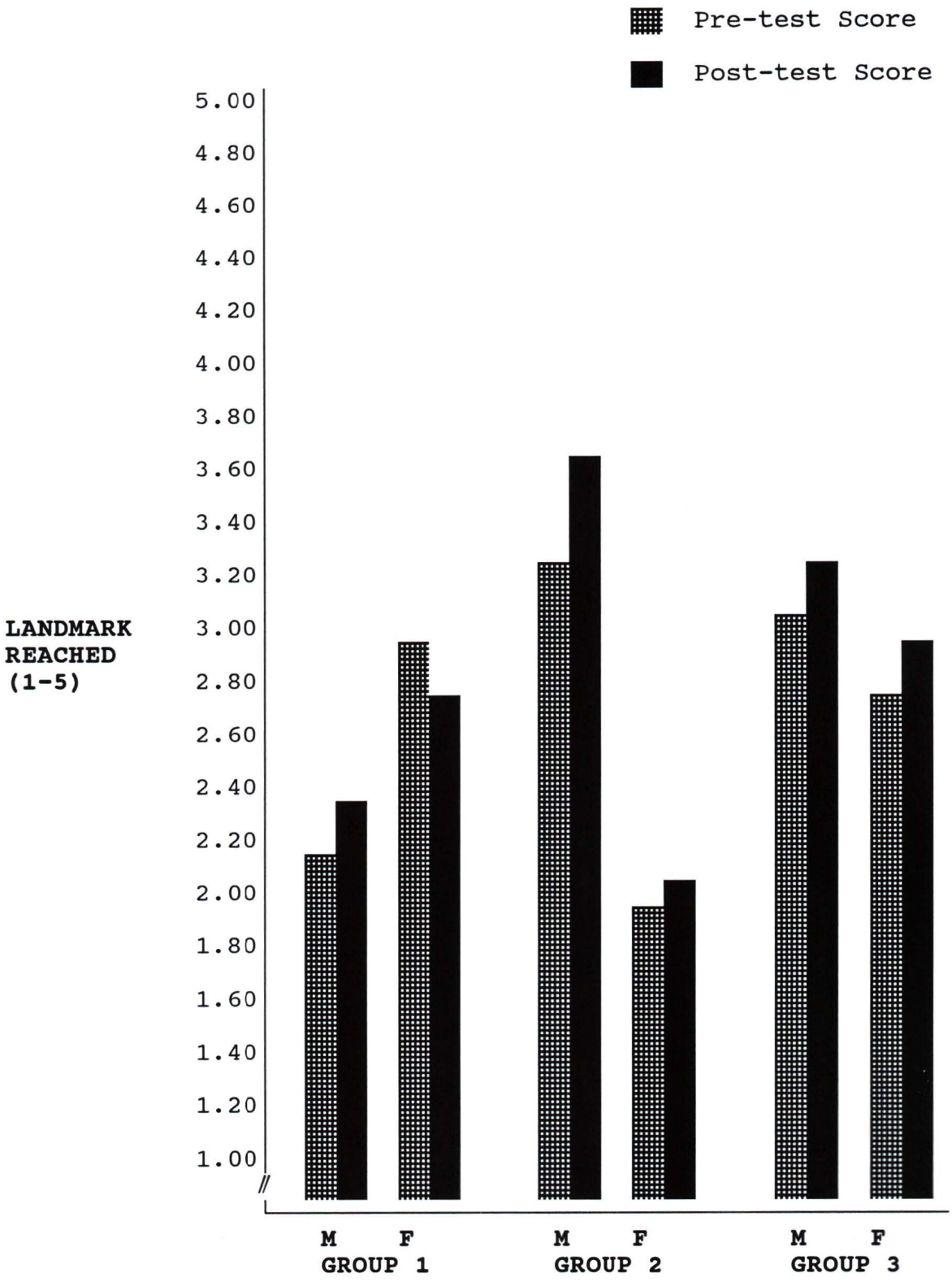


Figure 9. Pre-test and Post-test Scores for Left Trunk Lateral Flexion for Group 1, Group 2, and Group 3



Research Question #3

Does prescribed, self-monitored physical exercise increase psychological well-being as measured by self-esteem, depression, personal control, symptoms of aging and social satisfaction tests in older adults 50 - 90 years of age?

Group 3 males increased on two measures of psychological well-being (symptoms of aging and social satisfaction); however, neither of these was significant. They performed more poorly on two measures (self-esteem and depression) and stayed the same for personal control (see Figures 10-14). Group 3 females increased on all psychological well-being measures except for personal control. None of the changes were significant. Overall, prescribed, self-monitored physical exercise did not demonstrate any significant ($p<.05$) psychological well-being improvements in either males or females (Table 5).

Research Question #4

Does self-prescribed, self-monitored physical exercise increase psychological well-being as measured by self-esteem, depression, personal control, symptoms of aging and social satisfaction tests in older adults 50 - 90 years of age?

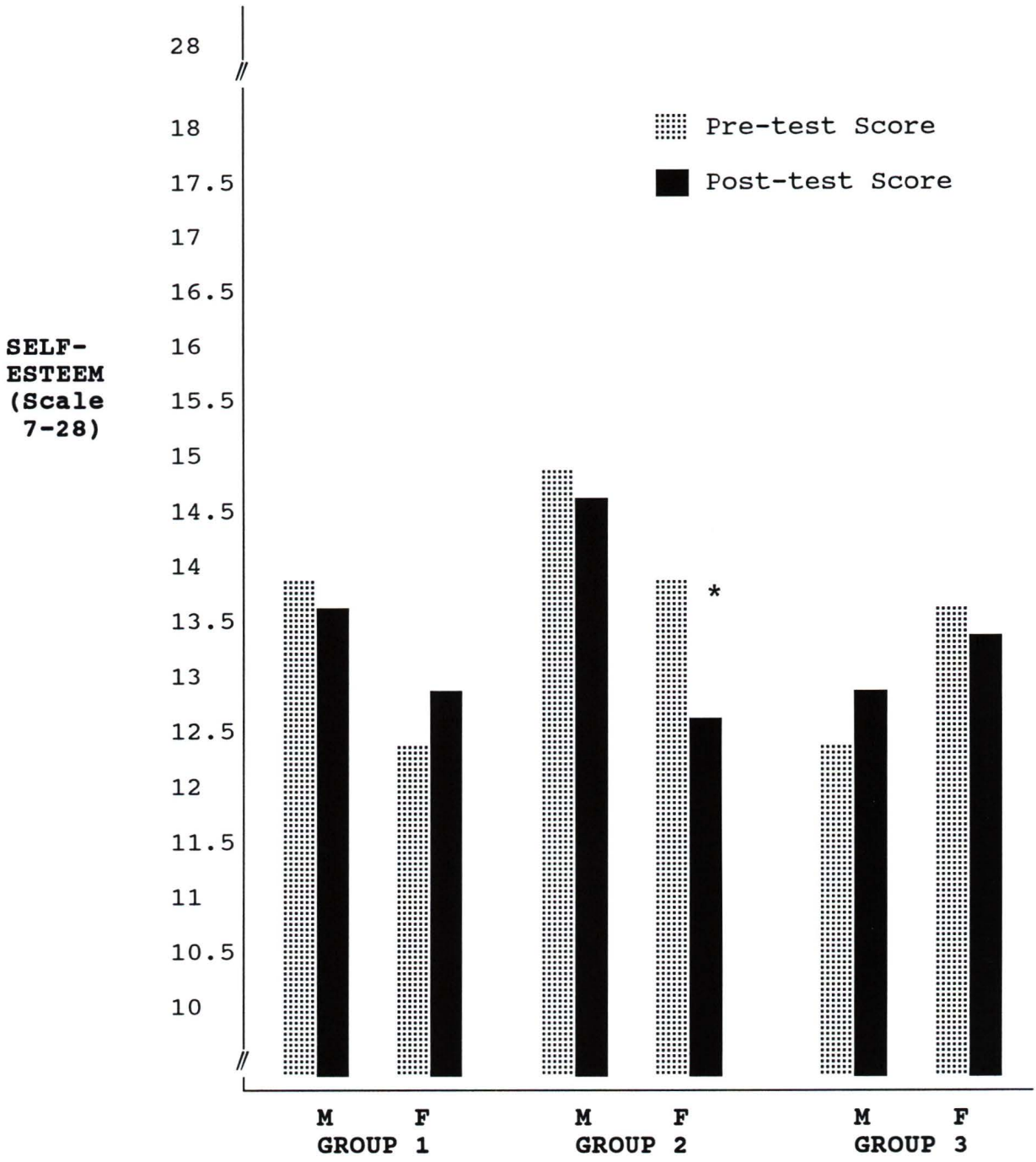
Group 2 females increased on social satisfaction and personal control; however, none of these changes were significant. They performed more poorly in symptoms of aging but stayed the same for

the depression measure. Self-esteem was the only psychological well-being variable that was significant ($p<.05$).

Group 2 males increased on two psychological well-being items (self-esteem and depression); however, neither of these changes were significant. They performed more poorly on the other three psychological well-being items (symptoms of aging, social satisfaction and personal control) over the nine week period.

Control group males increased in self-esteem, depression, symptoms of aging; however, none of these changes were significant. They performed more poorly in social satisfaction and personal control. Females increased in all psychological well-being variables except self-esteem. None of these changes were significant.

Figure 10. Pre-test and Post-test Scores for Self-Esteem for Group 1, Group 2, and Group 3



* $p<.05$

Figure 11. Pre-test and Post-test Scores for Depression for Group 1, Group 2, and Group 3

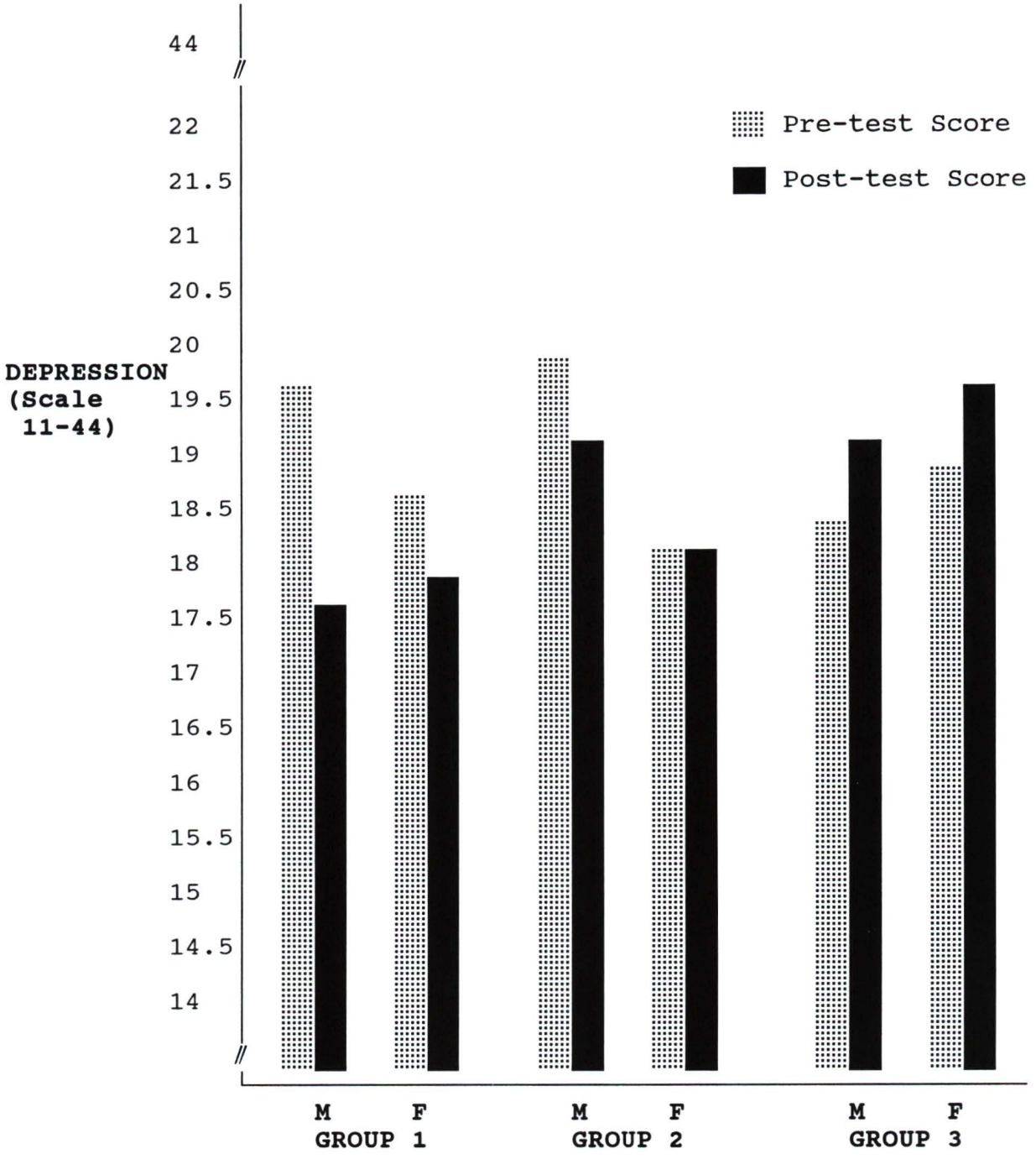


Figure 12. Pre-test and Post-test Scores for Symptoms of Aging for Group 1, Group 2, and Group 3

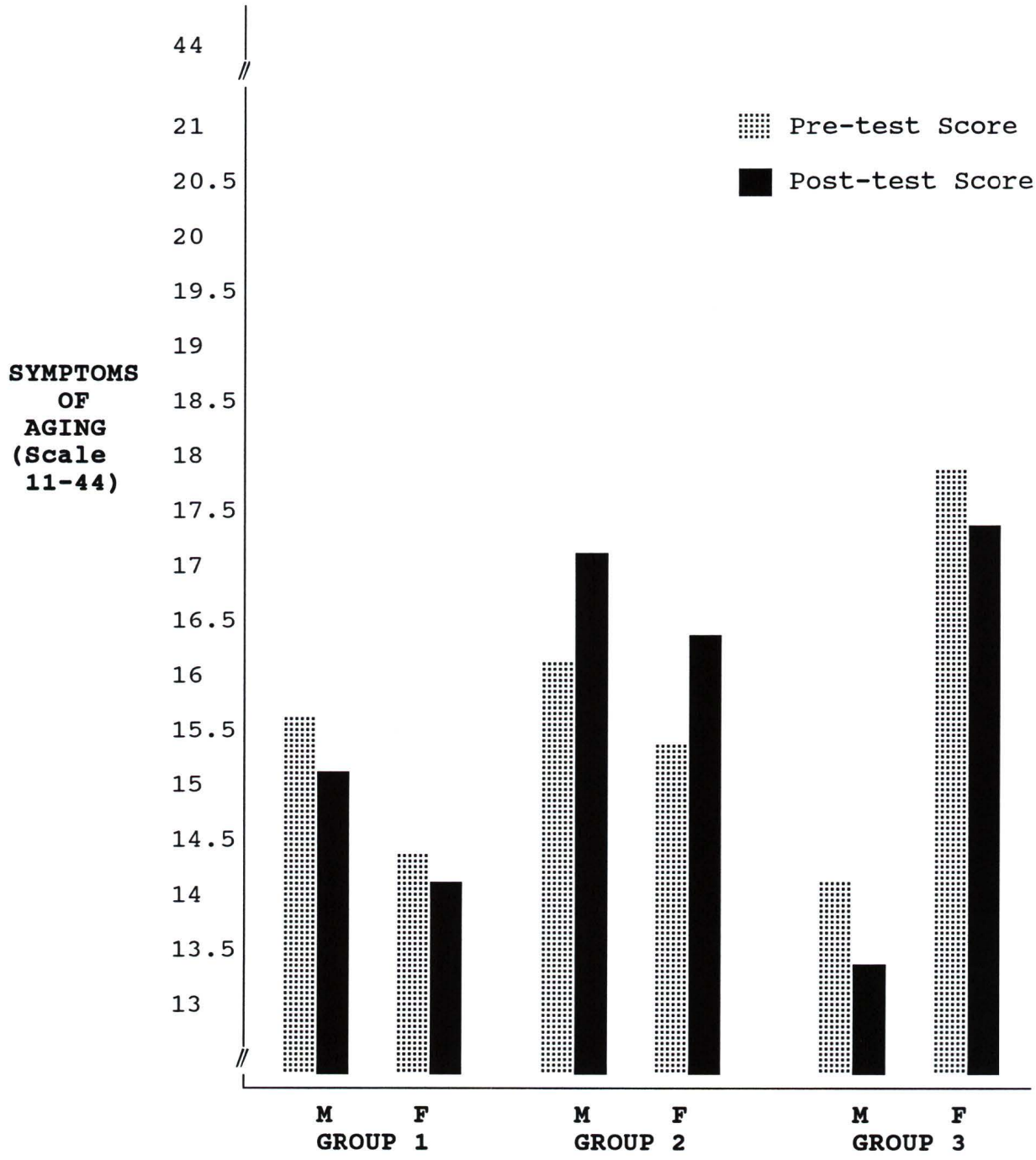


Figure 13. Pre-test and Post-test Scores for Social Satisfaction for Group 1, Group 2, and Group 3

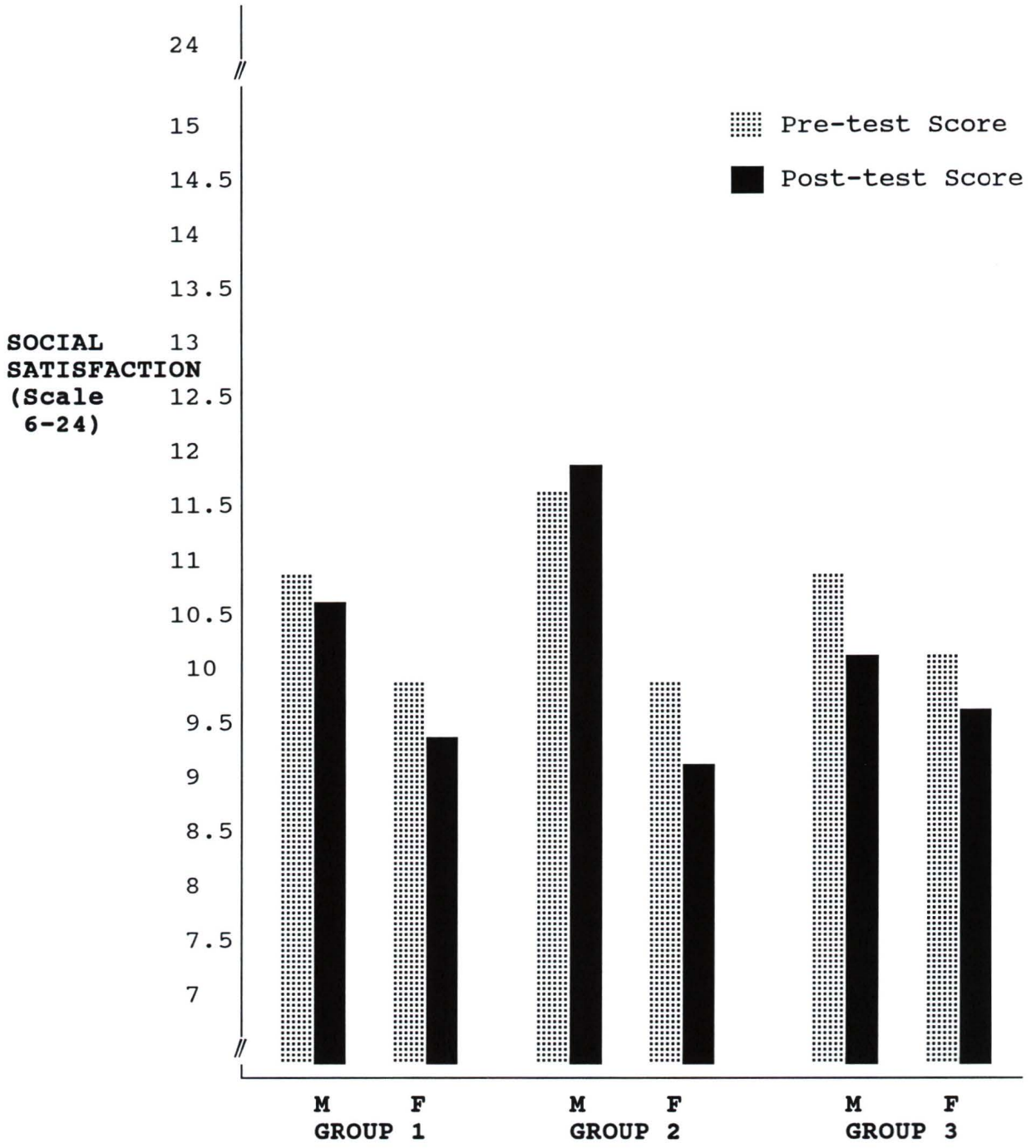
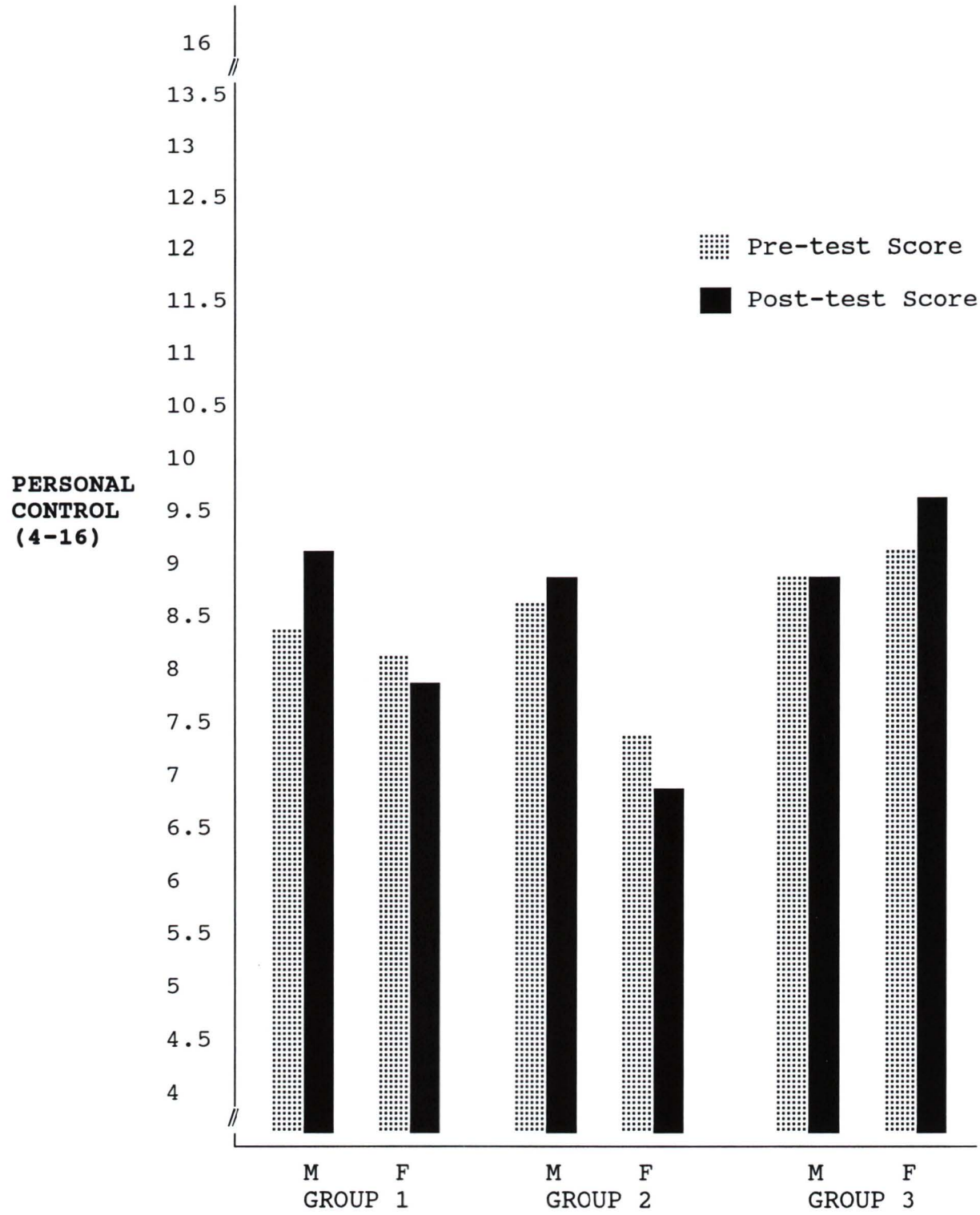


Figure 14. Pre-test and Post-test Scores for Personal Control for Group 1, Group 2, and Group 3



Activity Log Results

A MANOVA on the Activity Logs showed that there was a significant ($p<.05$) group difference but no sex or group by sex differences (Table 8). An univariate ANOVA indicated one of the three physical components to be significant ($p.<05$) between the three groups (Table 9). The variable was flexibility.

Post hoc group comparisons showed that Group 2 subjects spent significantly more ($p<.05$) hours ($X=0.61$) and weeks ($X=4.21$) on flexibility exercises than did the Control Group. Similarly, Group 3 subjects spent significantly more ($p<.05$) hours ($X=1.30$) and weeks ($X=2.81$) on flexibility exercises than did the Control Group. Group 1 walked significantly ($p<.05$) more than the other two groups (Table 10).

Table 8. MANOVA Results of the Activity Logs Based on Cardiovascular Endurance, Muscular Strength and Endurance and Flexibility Exercises

EFFECT	MULTIVARIATE F	p
Group	0.350	0.001
Sex	0.345	0.909
Group by Sex	0.454	0.939

Table 9. Univariate ANOVA Follow-up on the Activity Logs by Group Based on Cardiovascular Endurance, Muscular Strength and Endurance and Flexibility Exercises

VARIABLE	GROUP	X	F	p
Cardiovascular Endurance Hours per Week	1	3.01		
	2	1.78	1.53	0.219
	3	1.58		
Cardiovascular Endurance Number of Weeks	1	5.59		
	2	4.11	0.89	0.449
	3	4.06		
Muscular Strength and Endurance Hours per Week	1	0.93		
	2	0.53	0.61	0.550
	3	0.58		
Muscular Strength and Endurance Numbers of Weeks	1	2.41		
	2	2.37	0.32	0.727
	3	1.63		
Flexibility Hours per Week	1	0.00		
	2	*0.61	6.09	0.004
	3	*1.30		
Flexibility Number of Weeks	1	0.00		
	2	*4.21	8.09	0.001
	3	*2.81		

* Indicates which groups were significant ($p<.05$).

Table 10. Univariate ANOVA Follow-up on the Activity Logs by Group Based on Walking

VARIABLE	GROUP	X	F	p
Walking Hours per Week	1	*3.01		
	2	1.29	3.96	0.025
	3	0.98		
Walking Number of Weeks	1	*5.59		
	2	2.53	3.79	0.029
	3	3.44		

* Indicates which groups were significant ($p<.05$).

DISCUSSION

From the results, it would appear that nine weeks of participation in prescribed and self-prescribed exercise programs which are both self-monitored have conflicting outcomes on older adults in the area of physical fitness and psychological well-being. No significant ($p<.05$) between group differences were found in physical fitness or psychological well-being scores. However, some significant differences ($p<.05$) within groups were found.

BETWEEN GROUP DIFFERENCE

The lack of a significant treatment effect between groups on the physical fitness and psychological well-being measures may be explained by several factors. The nine week training period may have been insufficient time to generate changes in physical fitness and psychological well-being. Furthermore, the cumulative time line of the exercise program for individuals in Group 3 may have had a negative effect on their physical and psychological performance. Botwinick (1978) reported that the learning performance of an older individual is optimized when they are able to integrate new information at their own pace. That is, older adults may require more time than younger individuals when they are faced with learning new tasks or skills. Having a new exercise program to add to an existing one every three weeks may have been counter productive for Group 3 subjects.

Three weeks also may not have been sufficient time to successfully integrate a new exercise program into the previously existing one. It may be that the subjects in Group 3 needed longer than three weeks to successfully learn each exercise program and to experience a fitness benefit. Furthermore, with more exercises to do with each addition, the time to successfully integrate the exercise program into the subjects' daily life may have had to have been increased.

Ford et al. (1989) suggest that improvements found in control subjects from a pre-test to post-test period could account for the lack of between group significance on physical fitness or psychological well-being measures. In the present study, the Control Group experienced significant gains from the pre-test to the post-test on the Two Minute On-the-Spot Walk, Modified Curl-Ups and Push-Ups. Therefore, it may be postulated that improvements by the Control Group may have had a major impact on the lack of between group differences on the post-test scores for physical fitness and psychological well-being.

Shephard (1991) offers another alternative explanation for nonsignificant findings among groups. He concludes that because most older adults are wary about exercising they will err on the side of an insufficient amount of physical exercise. Since subjects in this study performed all the exercises on their own, one could infer that less rather than more exercises were performed because no one was present to

monitor subject performance. Assessment of the Activity Logs suggests that this is what may have occurred as Groups 2 and 3 were inconsistent and fairly low in the average number of hours and weeks they spent on exercises from the book, *Recipes for Fitness after 50: Personalized Exercise Programs (PEP!)*. Group 2 subjects failed to complete any of the cardiovascular endurance, muscular strength and endurance or flexibility exercises for over half of the nine week period. Similarly, Group 3 subjects failed to complete any of the prescribed exercises for over half of the prescribed time period.

A final alternative explanation for nonsignificant findings among groups could be the effect of the broad range of ages that were represented in each group. The heterogeneity of the groups produced small changes which could be explained by the large variability of the groups.

In summary, it is most likely that the lack of a significant group difference was a combination of circumstances. The length of the training period, the progressive nature of the training period for Group 3 subjects, significant increases within the Control Group on physical fitness measures, the subjects' tendency to err on the side of an insufficient amount of physical exercise, and a wide age range can be viewed as likely contributors to the lack of a significant treatment effect between groups.

WITHIN GROUP DIFFERENCES

Although there were several significant findings within groups, these findings were fewer than anticipated. There are several reasons which could explain why there were relatively few significant findings within groups on the physical fitness and psychological well-being measures. Shephard's suggestion of an inadequate exercise dose combined with the results of the Activity Logs for Group 2 and Group 3 most likely can account for the fact that these groups significantly improved in just three and two physical fitness areas respectively. Group 2 and Group 3 subjects did not participate in exercise on a regular basis so the likelihood of significant improvements occurring was extremely limited. Because the nature of this study was to demonstrate a link between physical fitness and psychological well-being, the lack of significant findings in the physical fitness area most likely affected the possibility of there being any enhancement of the psychological factors. As a result, there was only one significant finding of psychological well-being within one group. A possible reason for finding few significant physical fitness and psychological well-being improvements is put forward by Ford et al. (1989). They reasoned that a generic health-related test may not be able to detect fully the extent of any changes. The Self-Evaluation of Life Function (SELF) Scale is a short measure designed to assess overall psychological well-being and may not be sensitive enough to detect very small changes in an individual's psychological

performance. This may be particularly true for individuals who score relatively high in the first place. Similarly, the Post 50 is a simple self-test used for assessing overall physical fitness in older adults. Subjects are encouraged to stay within their "comfort zone" at all times during the performance of the test items. Therefore, it is difficult to test the subjects' full capabilities on the physical test items. The general nature of both the physical and psychological testing instruments may not have been sensitive enough to detect changes.

GROUP 1 (Control Group)

Group 1 males significantly improved on three components of physical fitness but did not show a corresponding improvement on any measure of psychological well-being. Even though Group 1 males were less psychologically fit at the outset of the study than Group 2 females (who also significantly improved on three physical fitness measures and showed some psychological improvement), Group 1 males did not improve psychologically even though they had more room to improve than Group 2 females. This finding refutes the "ceiling effect theory" which suggests that those individuals who score low on a psychological measure will be most likely to experience significant changes following exercise (Folkins et al., 1972; Hilyer and Mitchell, 1979). Group 1 females significantly improved on just one physical fitness measure

which could explain why no psychological well-being improvements were found.

GROUP 2

Group 2 females, those who participated in a self-prescribed, self-monitored exercise program, were the only subjects to show a significant improvement in one area of psychological well-being. They increased their levels of self-esteem. A phenomenon often reported in psychological literature is that women are more likely to improve psychologically because they are less psychologically "fit" than men at the outset of a study; and therefore, they have more room to improve (Folkins et al., 1972; Bennett, Carmack and Gardner, 1982; Netz et al., 1988). Contrary to this common occurrence reported in the literature, females in Group 2 reported higher levels of self-esteem at the beginning of the study than did the males in this group. This finding also refutes the "ceiling effect" theory mentioned earlier .

A possible explanation for the self-esteem improvements experienced by Group 2 females may be that they also accounted for most of the significant improvements in physical fitness. They improved on Curl-Ups, Push-Ups and Sit and Reach. It may be that these physical fitness improvements enhanced their feelings of self-esteem.

The majority of research studying the effects of physical fitness on various psychological variables has used cardiovascular endurance as the main component of the exercise

intervention. Sometimes cardiovascular endurance exercises are combined with either muscular strength and endurance or flexibility exercises to demonstrate that a positive relationship between physical fitness and psychological well-being exists. Hilyer and Mitchell (1979) used distance running and flexibility, Collingwood (1972) combined jogging and sprints with strength exercises, Collingwood and Willet (1971) combined jogging and swimming while McGowan et al. (1974) used endurance running only. All four studies showed corresponding increases in self-esteem among their subjects as their fitness level rose. The present study, however, showed that self-esteem could be enhanced by increases in flexibility and muscular strength and endurance alone. Group 2 females showed no significant improvement in either cardiovascular measure on the Post 50 Test. Valliant and Asu (1983) offer support for this finding. These authors used selected calisthenics and flexibility exercises for their 12 week program and found a significant ($p<.05$) increase in self-esteem for the men in their study. As for Group 2 males, since they did not improve significantly on any physical fitness measures, it can be inferred that this was why they reported no significant psychological well-being improvements.

It is not clear why Group 2 females performed so much better than Group 2 males particularly since no significant sex differences were reported on the Activity Logs. Even though no significant differences were found between the sexes

on the Activity Logs, it could be that the differences which did occur were enough to affect the post-test results. Furthermore, it may be that the subjects were not completely accurate in recording their Activity Logs which could also account for the difference. The full complexity of how males and females relate to self-prescribed exercise programs has not been investigated to date. It may be that the sex difference reported reflect the different experiences, needs and desires that males and females bring to such a situation.

GROUP 3

The relatively poor performance of Group 3 subjects may be explained by Botwinick's (1978) self-pacing theory mentioned earlier. In contrast to Group 2 subjects who were able to progress at their own pace in their own exercise program, Group 3 subjects had no control over the timing of their exercise program. According to Botwinick (1978), performance is optimized when older individuals are allowed to go at their own pace. Since Group 3 subjects were not able to go at their own pace concerning their exercise program, it could have negatively affected their performance. A second reason for the performance of Group 3 subjects can be found within the literature of adult education.

Adult education can be described as the shared responsibility between a facilitator and a learner to help the learner fulfil their needs and accomplish their goals

(Knowles, 1980). The development of adult education centres around an educational process called andragogy. The classical definition of andragogy is "the art and science of leading adult learners" (Ingalls, 1972, p. 10). The main tenet of andragogy is self-directed learning focusing on individual interests and needs. That is, the learner decides what they need to learn based on their own perception of the situation. Ingalls (1973) suggested that individuals are more likely to explore an area which has interest to them or a situation that presents a particular problem. Similarly, Shephard (1991) proposed that physical activities used in research projects should reflect the interests of the participants. In contrast to Group 2 subjects who were able to explore the physical fitness areas that they wished or needed to pursue, Group 3 subjects were given no flexibility at all as to which exercises to perform since all exercises were chosen by the investigator. Lippitt (1986) suggested that learning should be self-directed rather than imposed. According to Strachan (1982), "adult learning is enhanced when learners perceive that the learning process and its results have personal meaning to them and are relevant to their own purposes" (p. 28). Therefore, it can be argued that Group 3 subjects performed poorly because they were not given the option to choose exercises which had specific meaning to them. Although the concept of adult education has yet to be integrated into the physical fitness and exercise literature, many of the

adult education constructs can and should apply to physical fitness programming for older adults.

CONCLUSIONS

1. Males and females who participated in a prescribed, self-monitored exercise program showed significant improvement on two of nine physical fitness measures. Males improved on Modified Push-Ups and females improved on the Two Minute On-the-Spot Walk.

2. Males who participated in a self-prescribed, self-monitored exercise program showed no significant improvements on any of the nine physical fitness measures. Females showed significant changes in three of the nine physical fitness measures. They improved on Curl-Ups, Modified Push-Ups and Sit and Reach.

3. Males and females who participated in a prescribed, self-monitored exercise program reported no significant improvements on any of the five psychological well-being measures.

4. Males who participated in a self-prescribed, self-monitored exercise program showed no significant improvements on any of the five psychological well-being measures. Females reported a significant change on one of the five psychological well-being measures. They increased their level of self-esteem.

RECOMMENDATIONS

Future research in this area will need to identify a sedentary control group in order to better portray the effect of exercise on physical fitness and psychological well-being. Second, it is recommended that a follow-up testing session be performed several weeks and/or months after discontinuing the exercise program in order to examine long-term effects of exercise on psychological well-being. Specific research addressing the effect of exercise on social satisfaction and personal control needs to be conducted since little work has been performed in this area. Also recommended is further exploration of psychological well-being changes in relation to physical fitness changes by comparing two groups: one group who receives a prescribed, monitored exercise program and one group who follows a self-prescribed, self-monitored exercise program. Finally, since the profile of the senior population appears to be that they are exercising more at home and alone, research in the area of physical fitness and psychological well-being must reconsider its use of standard exercise interventions commonly used.

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APPENDIX A

Literature Review

LITERATURE REVIEW

POPULATION GROWTH AND OLDER ADULTS

More Canadians than ever before are living beyond 65 years of age. The life expectancy for males in 1931 was 60 years and 62.1 years for females (Canada World Almanac, 1990). By 1986, the average life expectancy for males was 73 years (22% increase) and 79.7 years (28.5% increase) for females.

In 1901, individuals 65 years of age and over accounted for approximately 250,000 or 4.6% of the total Canadian population of 5.4 million people (Health and Welfare Canada, 1983). By 1981, this figure had reached a total of 2.4 million or 9.7% of the total population of 24.3 million people (Health and Welfare Canada, 1983). In 1986, almost 11% or 2.7 million people of the Canadian population was over 65 years of age (Canada World Almanac, 1990). By the year 2000 it is expected that 3.2 million Canadians will live past 65 years of age (Burdman, 1986). The increase of individuals over 80 years of age has also increased from 40,000 people in 1901 to 415,000 people in 1981. By 2021, projections envisage this number to increase to just over one million people.

PHYSICAL ACTIVITY AND OLDER ADULTS

In 1976, 50% of the individuals 65 years of age and over were physically active; by 1981 this number had risen to 63% (Canada Fitness Survey, 1982). By 1988, 75% of the males and

69% of the females 65 years of age and over were physically active (Stephens and Craig, 1990). In fact, individuals 65 years of age and over have identified regular physical activity as one of the most important contributors to overall well-being (Stephens and Craig, 1990). The 1981 Canada Fitness Survey which examined the fitness habits of nearly 22,000 Canadians age 10 - 97 years reported that individuals 55 years of age and over felt that the most important reason to exercise was "to feel better mentally and physically" (p. 6).

The Campbell's 1988 Survey on the Well-being of Canadians was a follow-up to the 1981 Canada Fitness Survey. The Campbell's survey found that exercising at home becomes more common as individuals age (Stephens and Craig, 1990). The survey found that 39% of the males and 41% of the females 65 years of age and over exercised at home compared to 34% of individuals 45 - 64 years of age and 25% of individuals 25 - 44 years of age (Stephens and Craig, 1990). Amundsen, DeVahl and Ellingham (1989) suggested that the older population may exercise at home because it is convenient, inexpensive, and requires no special equipment. Environmental factors, such as inclement weather, transportation problems, and high crime areas may also influence seniors to stay at home.

It has been reported that the tendency to exercise alone increases with age (Stephens and Craig, 1990). The Campbell's survey found that 60% of the males and 57% of the females 65

years of age and over exercised alone (Stephens and Craig, 1990). A study investigating activity patterns of elderly Germans found that 60% of the subjects exercised alone (Baltes, Wahl and Schmid-Furstoss, 1990). A possible explanation for this phenomenon may be that the types of activities chosen by older adults are usually individual activities such as walking, gardening and home exercise (Stephens and Craig, 1990). In summary, older individuals have identified physical activity as an important component of their overall physical and mental well-being. Further, it would appear that older adults may prefer to exercise at home and alone.

PHYSICAL FITNESS BENEFITS OF EXERCISE

There are many physical fitness benefits of exercise that can be achieved by older adults through a program of regular exercise. These physical fitness benefits can include improvements in cardiovascular endurance, muscular strength and endurance, and flexibility.

Cardiovascular Endurance

Cardiovascular endurance refers to the ability to perform physical activities that work the circulatory and respiratory systems over an extended period of time (Fitness Ontario, 1986). Good cardiovascular endurance in older adults is important because it allows everyday tasks such as walking to the store, climbing a set of stairs, or mowing the lawn to be more easily and safely performed. Good cardiovascular endurance may also help reduce the risk of heart disease by lowering blood pressure and preventing clogged arteries and veins through a reduction in body fat content (Shephard, 1990).

A wide range of studies using different treatments and time periods have consistently shown that cardiovascular improvements may be achieved through regular exercise. Amundsen, DeVahl, and Ellingham (1989) found an increase of 12.4% in the predicted maximal aerobic power in 14 women with a mean age of 75 years as a result of an instructor-led exercise class conducted twice a week for eight weeks. They

also found significant decreases ($p<.05$) in heart rate and blood pressure. No special exercise equipment was used. A 12 week study by Hopkins, Murray, Hoeger and Rhodes reported a significant ($p<.01$) improvement in the cardiovascular endurance in women with a mean age of 65 years who participated in a low impact aerobic dance class three times a week. An 11 week study by Blumenthal, Schocken, Needels and Hindle (1982) reported significant increases ($p<.01$) in individuals 65 - 85 years of age in cardio-endurance as measured by time and workload on a cycle ergometer. Significant cardiovascular responses ($p<.01$) of women ranging from 52 - 79 and 70 - 79 years of age were found after an endurance exercise program of 13 and 24 weeks respectively (Adams and de Vries, 1973; Hagberg et al., 1989).

Muscular Strength and Endurance

Muscular strength is the maximum effort that a muscle or group of muscles can exert in a single contraction (Fitness Canada, 1987). Muscular endurance is the ability of a muscle or group of muscles to perform repeated contractions over a period of time (Fitness Canada, 1987). Muscular strength and endurance in older adults is important because it allows every day tasks such as carrying groceries, chopping wood or unscrewing a lid from a jar to be more easily and safely performed.

Agre, Pierce, Raab, McAdams and Smith (1988) reported a

significant increase ($p<.01$) in upper and lower body muscular strength and endurance in women 63 - 88 years of age following a 25 week program of light resistance exercises. There were two experimental groups; one which used light ankle and wrist weights and one which used body weight. Both groups showed improvement ranging from an 11% increase in knee flexion to a 17% increase in elbow extension. There was no significant difference between the groups. Brown, McCartney and Sale (1990) also found significant increases ($p<.05$) in strength in the upper limbs of males with an average age of 63 years over a 12 week period of structured weight training sessions.

Physical gains in lower extremity muscular strength and endurance in men 60 - 72 years of age have been reported after 12 weeks of a structured strength training program using Universal weight machines (Frontera, Meredith, O'Reilly, Knuttgen and Evans, 1988). The investigators reported an increase in the strength of knee extensors and flexors of 107.4% ($p<.0001$) and 226.7% ($p<.0001$) respectively. More recently, Fiatrone, Marks, Ryan, Meredith, Lipsitz and Evans (1990) showed that individuals 90 years of age and older can significantly ($p<.0001$) increase mid-thigh muscular strength after eight weeks of high intensity strength training. These investigators found that the strength gains in knee extensors and flexors ranged from 61% to 374% with an average gain of 174%.

Flexibility

Flexibility is the range of possible movement at a joint or series of joints (Fitness Canada, 1987). Flexibility in older individuals is important because everyday activities such as reaching for dish in a high cupboard, bending over to put on socks, or reaching around into the back seat of a car are performed more easily and safely. There are few published studies on the effect of exercise on the flexibility of older adults. The studies that have been documented report that positive changes in flexibility through exercise can occur in older adults. Raab, Agre, McAdams and Smith (1988) reported a significant improvement ($p<.05$) in the flexibility of women 63 - 89 years of age and over at various anatomical joints after a 25 week program of light resistance and stretching exercises. Munns (1981) found that subjects with a mean age of 71.8 years exhibited a significant increase ($p<.05$) in the range of motion at six body sites following a 12 week exercise program of passive and active stretching exercises.

Two unpublished master's theses reported positive flexibility changes in older adults following an exercise program. Cline (1989) found significant increases ($p<.05$) in flexibility at various joints in osteoarthritic women 55 years of age and over after an eight week program of land and water exercises. Clark (1988) found significant increases ($p<.05$) in flexibility at the knee, hamstrings and lower back in women with an average age of 76 years after an eight week aerobic

class.

The evidence in the research literature is consistent. Significant improvements in cardiovascular endurance, muscular strength and endurance and flexibility can be achieved by older adults through a variety of regular exercise programs.

PSYCHOLOGICAL BENEFITS OF EXERCISE

Over the years, there has been much interest surrounding the possible existence of a mutually positive relationship between physical fitness and psychological well-being. Just as scholars in ancient Greece were interested in this holistic approach to well-being, today's researchers have also been stimulated by the proposed relationship between physical fitness and psychological well-being. Psychological well-being benefits that may be achieved by older adults through regular physical exercise include factors such as an enhanced self-esteem, a decrease in depression, an increase in personal control, improved symptoms of aging, and greater social satisfaction. A review of the current literature in this area, however, reveals equivocal findings (Parent and Whall, 1984; Millar, 1987; Blumenthal et al., 1982; Valliant and Asu, 1985).

Self-Esteem

Self-esteem is the degree to which an individual feels positive about him/herself (Sonstroem, 1984). Self-esteem is the confidence a person possesses in their own worth regardless of any weakness or inadequacies (Sonstroem, 1984). It has been postulated that physical activity can have a positive effect on self-esteem.

Collingwood and Willet (1971) reported a significant increase ($p<.05$) in self-concept and self-acceptance of obese

teenage boys after three weeks of physical training in a gymnasium and in a pool. A year later, Collingwood (1972) reported similar findings ($p<.05$) in males 18 - 26 years of age after four weeks of cardiovascular endurance work, strength exercises and agility drills. Similarly, McGowan, Jarman and Pedersen (1974) reported a significant increase ($p<.05$) in self-esteem in grade seven boys after an 18 week running program. Another study combined a 10 week exercise program with a counselling program for college students (Hilyer and Mitchell, 1979). A significant increase ($p<.05$) in self-concept was found only in those students who received the physical training and counselling and who had low self-concepts at the beginning of the study. One reason that high self-concept subjects who also received the 10 week exercise and counselling program did not show a significant change may be that individuals who already have a high self-concept do not have as much potential for show improvement as someone who has a low self-concept. This phenomenon has been termed the "ceiling effect" (Hilyer and Mitchell, 1979). Finally, a study by Tucker (1982) reported a significant increase ($p<.05$) in self-esteem in college males after a 16 week weight training program.

The literature also suggests that there is a positive relationship between self-esteem and physical activity in older adults. Valliant and Asu (1985) studied 114 individuals 50 - 80 years of age and found a significant increase ($p<.05$)

in self-esteem in males after a 12 week exercise program. Although females were also included in the study, no significant increase in self-esteem was found. Parent and Whall (1984) reported a positive correlation between self-esteem and monthly physical activity in seniors 60 years of age and over.

There is also research which does not lend support for a positive relationship between physical activity and self-esteem. Ford, Puckett, Blessing and Tucker (1988) found no significant difference in self-esteem between a control and experimental group of 108 female college students over eight weeks of selected physical activity training. Furthermore, no significant differences between pre-test and post-test self-esteem scores were apparent in the experimental group. No significant improvement was found in self-concept following a 12 week walking program for geriatric mental patients (Stamford, Hambacher and Fallica, 1974). There was no reported change in self-esteem in females 50 - 64 years of age following a 12 week training program even though they reported a significant increase ($p<.05$) in their overall well-being (Netz, Tenenbaum and Sagiv, 1988). It would appear that the relationship between self-esteem and physical activity remains unclear.

Depression

Depression is an emotional state of mind characterized by feelings of gloom, inadequacy, tension and anxiety (Novak, 1988). It has been suggested that a sedentary elderly population exhibits more depression than those individuals who remain physically and socially active (Valliant and Asu, 1985). According to the Canada Health Survey of over 23,000 Canadians, 4% of the males and 8% of the females 65 years of age and over, reported symptoms of anxiety and depression (Health and Welfare Canada and Statistics Canada, 1981). This is approximately 7.7% of the elderly Canadian population.

There is substantial support for the benefits of physical activity on depression (Martinsen, Medhus and Sandvik, 1985; Silver, 1989). Folkins, Lynch and Gardner (1972) reported significant improvements ($p<.001$) in psychological "fitness", including depression, in female college students after a 29 week jogging program. Although males were also included in the study, no significant psychological differences were found. The women in this study were found to be both less physically and psychologically fit at the beginning of the study compared to males. This study suggests that those individuals who are low on various physical and psychological variables, prior to an intervention, will show the greatest improvement. Four years later, Folkins (1976) reported a significant decrease ($p<.05$) in anxiety and depression in males 40 - 58 years of age after 12 weeks of exercise.

Significantly lower depression scores were reported in 114 adults 50 - 80 years of age after involvement in a 12 week structured exercise program ($p<.01$) (Valliant and Asu, 1985) and in 30 seniors over 60 years of age who performed physical activity on a monthly basis ($p<.05$) (Parent and Whall, 1984).

The studies by Morgan, Roberts, Brand and Feinerman (1970) and Morgan, Roberts, and Feinerman (1971) do not provide support for the premise that exercise can have a beneficial effect on depression. Morgan et al. (1970) found no significant difference in depression for an experimental group of males with a mean age of 40 years who followed a six week exercise program. The investigators did find a significant decrease ($p<.01$) in depression in those individuals who were depressed at the outset of the study. This finding tends to support other studies (Folkins et al., 1972; Hilyer and Mitchell, 1979) which indicated that it is uncommon for individuals scoring within normal ranges on various psychological measures to experience significant changes following an exercise program. Morgan et al. (1971) reported an increase in depression levels following an intervention of acute exercise on a cycle ergometer and a treadmill. This study referred to acute exercise as raising the subject's heart rate to a criterion level of 150 - 180 beats per minute. After completing a depression questionnaire, subjects were assigned to either a treadmill or cycle ergometer exercise condition which would evoke 150, 160,

170 or 180 heart beats per minute. After reaching the target heart rate, the subject performed a five minute cool-down and then filled out a depression questionnaire. The investigators found no significant decrease ($p<.05$) in depression in either group. However, the investigators did find that subjects with heart rates of 150 and 160 beats per minute who were exercising on a cycle ergometer had significantly higher ($p<.05$) depression scores than those subjects with heart rates of 160 beats per minute who were exercising on a treadmill. This study suggests that acute, high intensity exercise does not stimulate positive changes in the anxiety and depression levels of individuals.

Millar's study (1987) of psychological well-being and physical fitness took a somewhat different approach from other studies. He stated, "Physical fitness is a feeling of well-being, not a mathematical measure of pulse rate." He suggested that the aim of exercise was to make the person "feel better", regardless of their improvement in physical fitness. His study utilized a low intensity exercise program, two - three times a week over three months. He found a significant decrease in depression ($p<.02$) and tension ($p<.001$) among his elderly subjects but not a decrease in pulse rate which was used as the cardiorespiratory measure. It would appear that regular physical exercise performed several times a week for a couple of months may have the potential to improve depression levels in older adults.

Personal Control

Personal control, or "life mastery", is the extent to which an individual feels that they have control over life situations which affect them (Slivinske and Fitch, 1987). A number of conditions usually associated with aging such as declining health, loss of social or occupational roles, loss of income, or widowhood can affect personal control (Linn and Linn, 1984; Hansson and Remondet, 1988). Few studies have directly investigated the relationship between personal control and physical activity. The studies documented tend to include physical activity in the definition of overall health or well-being. There is limited support for a positive relationship between personal control and physical activity.

Baltes et al. (1990) investigated the relationship between functional health, personal control and activity in 49 German individuals with a mean age of 72.7 years. The investigators found that subjects who reported to be most frequently involved in physical leisure activities also reported high levels of personal control. Slivinske and Fitch (1987) investigated the effect of control-enhancing interventions on the well-being of 63 elderly residents who lived in a retirement community. The subjects were divided into two groups. The control group received no intervention. The experimental group received one hour of classes, twice a week for 10 weeks in stress management, nutrition awareness, the immediate environment, self-responsibility and

spirituality. They also attended physical education classes three times a week for 20 weeks. The investigators reported a significant increase in perceived control ($p<.01$) and a corresponding increase in physical health ($p<.01$) in the experimental group. This group reported increases in muscular strength and flexibility. This study did not examine the extent to which individual program elements contributed to perceived control. Therefore, it cannot be determined if the change in perceived control was the result of a particular program element or a combination of program elements. Winocur, Moscovitch and Freedman (1987) reported a significant relationship ($p<.05$) between feelings of personal control and activity in 46 individuals with a mean age of 80.7 years. The investigators did not distinguish between physical activity and passive activity so it was not clear what the specific relationship was between personal control and physical activity.

The existing literature on personal control and physical activity is scarce and is not designed to isolate the relationship between personal control and physical activity. It does offer some support to the idea that there may be a positive relationship between these two variables.

Symptoms of Aging

Symptoms of aging are health conditions which often accompany old age such as chronic diseases, extensive medication use, pain, soreness or lack of energy (Linn and Linn, 1984). About 86% of individuals 65 years of age and over report at least one health problem (Health and Welfare Canada, 1983). Some of the most common health problems cited in individuals 65 - 74 years of age were arthritis and rheumatism (males=31%; females=47%), hypertension (males=19%; females=32%), limb and joint disorders (males=18%; females=18%), heart disease (males= 17%; females=15%), and hearing disorders (males=19%; females=9%). The most common health problems for females 75 years of age and older were arthritis and rheumatism (55%) and hypertension (44%). The most common health problems for males of the same age were arthritis and rheumatism (36%) and hearing disorders (34%).

A review of 30 years of research on well-being in older adults revealed that good health is one of the most important variables contributing to feelings of well-being (Larson, 1978). Although physical activity cannot eliminate chronic disease, it can help to promote good health and to improve some of the symptoms of aging.

As far back as 1965, doctors were regularly prescribing exercise regimens for health conditions such as low back pain, insomnia and chronic headaches (Cureton, 1965). Piscopo (1985) advocated exercise prescriptions for a variety of

conditions that affected mobility among older adults such as osteoporosis, impaired peripheral vascular circulation and lumbar back disorders. Today, many national health organizations advocate regular exercise as one of a combination of prevention methods or treatments for various chronic illnesses. Exercise is often prescribed for osteoporosis, diabetes, high blood pressure and cardiac rehabilitation (The Arthritis Society; Canadian Diabetes Association; Canadian Heart Foundation and American Heart Association). Emery, Pinder and Blumenthal (1989) state that aerobic exercise is practically universally accepted as a critical component of successful cardiac rehabilitation programs.

Many studies have not specifically addressed the issue of the impact of physical activity on symptoms of aging. Most studies are limited to those individuals who are in good health (Sidney and Shephard, 1976; Blumenthal et al., 1982). Netz et al. (1988) rejected 29% of their subjects for "medical reasons". It is difficult, then, to address health conditions related to aging when individuals with these conditions are being precluded from participation in exercise studies.

One group of researchers specifically used individuals with chronic conditions in their study of a supervised exercise program for a geriatric population (Morey et al., 1989). The 49 participants were 64 years of age and over and all experienced at least one chronic condition. The most common chronic diseases listed were arthritis, hypertension

and heart disease. The experimental group exercised three times a week for four months and experienced significant changes in various aspects of their health such as a decrease in resting heart rate of 4.8 beats per minute ($p<.05$) and a decrease in cholesterol of 9.7 mg/dL ($p<.01$). Another study used "at risk" males, 40 - 58 years of age, from police and fire departments and found a significant decrease ($p<.01$) in systolic blood pressure in those individuals who participated in a 12 week exercise class (Bonanno and Lies, 1974; Folkins, 1976). The investigators also found a significant reduction ($p<.05$) in hypertriglyceridemia in the exercise group when measured 24 hours after an exercise session.

Physical health has been strongly linked to optimal well-being in older adults (Larson, 1978). However, reserach which specifically investigates symptoms of aging and physical fitness is limited.

Social Satisfaction

Social satisfaction is the extent to which individuals feel content with the type, amount and quality of social interaction they receive (Linn and Linn, 1986). Social satisfaction can include telephone calls, visiting friends and relatives, having a hobby, or attending church, clubs, get-togethers or meetings (Linn and Linn, 1984). Literature discussing the impact of physical activity on social satisfaction of older adults is limited. There is one study which offers some insight into this issue.

In examining patterns of participation in physical activity among elderly Belgium citizens, Vanreusel, Roland and de Meyer (1983) found that seniors 60 years of age and over who showed a high degree of social contact with their contemporaries were more likely to be involved in physical activities. It is not stated that the subject's social satisfaction increased as a result of physical activity participation, but it is possible to infer that a high degree of social contact may be positively related to a high degree of social satisfaction. Although this study does not directly address the issue of whether physically fit individuals are more socially satisfied, it does show that a positive correlation between physical activity and social contacts may exist. To date, there has been no research which specifically addressed the relationship between physical fitness and social

satisfaction.

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APPENDIX B

Informed Consent Form and

Physical Activity Readiness Questionnaire (PAR-Q)

INFORMED CONSENT FORM AND PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

NAME:_____ **DATE:**_____ **Subject No:**_____

ADDRESS:_____

Apt. # / Street # City Postal Code

AGE:_____ **SEX:** M F **TELEPHONE:**_____

Thank you for agreeing to participate in this worthwhile project. We would appreciate it if you would take a minute to read the following material and respond to the questions posed.

Each participant will be asked to complete the following:

1. A Physical Activity Readiness Questionnaire (PAR-Q).
2. A Project Consent Form.
3. An Activity Appraisal Questionnaire
4. A Wellbeing Questionnaire.
5. The Post 50 Test (description below).
6. An Activity Log during the experimental period.

For most people, physical activity should not pose any problem or hazard. PAR-Q (Physical Activity Readiness Questionnaire) has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them. If any of the following holds true for you, please indicate in the space provided with a check (✔).

PHYSICAL ACTIVITY READINESS QUESTIONNAIRE

Has your doctor ever said that you have heart trouble?
() **YES**

Do you frequently suffer from pains in your heart or chest?
() **YES**

Do often feel faint or have spells of sever dizziness?
() **YES**

Has a doctor ever said your blood pressure was too high?
() **YES**

Do you frequently suffer from pains in your heart or chest?
() **YES**

Has your doctor ever told you have bone or joint problem such as arthritis that has been aggravated by exercise, or mith be made worse by exercise?
() **YES**

Is there a good physical reason not mentioned here why you should not follow an activity program even if you wanted to?
() **YES**

The Post 50 Physical Performance package has been developed to provide Canadian men and women of 50 years and older with a means of measuring their present levels of stamina, strength and suppleness.

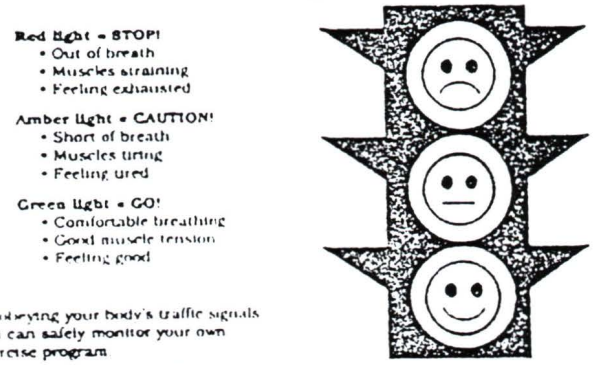
The stamina measure includes a walk of 440 metres (approximately one city block) and walking on-the-spot for two

minutes. The walk might be similar in effort to a brisk walk to post a letter or visit a store.

The suppleness measures include standing and raising one arm over your head, standing and bending sideways at the waist, standing and turning sideways at the waist and sitting and bending forward at the waist. These movements are simple, everyday actions and will be measured within your normal range of motion. In other words, you will perform each movement in a comfortable fashion, without straining. The effort involved would be similar to reaching for a high shelf at home or bending over to tie your shoes.

The strength and endurance measures include curl-ups and modified push-ups. "How To" instructions will be provided for these items prior to testing. Physical effort is required to perform curl-ups and modified push-ups, however, careful self-monitoring of the body's traffic signals listed below will enable an appropriate safe performance.

When completing various test items, it is essential that you stay within your personal comfort zone. Obey the body traffic signals!



Participation in this program should be an interesting, fun experience for all concerned. The voluntary nature of this program allows each subject to participate at his\her own level and, if desired, to withdraw at any time. Thank you again for your assistance.

_____ _____

Dr. R.D. Bell — Principal Investigator

Tessa Graham — Research Assistant

"I, _____, consent to take part as a subject in the project "Post 50 Physical Performance Test". I understand the project, and am satisfied that my state of health is adequate to carry out my part of the project without risk to myself. I, therefore, absolve the researchers and the University of Victoria from any claim arising out of injury to myself incurred while taking part in the project as described to me."

_____ _____

Signature — Date

APPENDIX C

"Dear Doctor" Form

July 10, 1991

Dear Doctor:

_____ has volunteered to participate in the Post 50 Research Project at the University of Victoria involving physical activity. The Physical Activity Readiness Questionnaire (attached) is part of the screening process for this research project and _____ has answered Yes to the questions indicated which would normally exclude a subject from participation. _____ would still like to participate. To do so, a medical clearance is required.

For the record, all physical activity in this research is restricted to "comfort zone" intensity. In addition, the subjects themselves control the amount and duration of all exercise activity. Outlined below is the research protocol in which _____ would be involved.

1. The Post 50 "3-S" Test once on July 22-24 and then nine weeks later on September 28-29.

2. _____ is in Group ____ which will entitle him/her to _____ over the nine week period.

About the Post 50 Test

The Post 50 "3-S" Physical Performance Test has been developed to provide Canadian men and women of 50 years and older with a means of measuring their present levels stamina, strength and suppleness.

The stamina measure includes a brisk walk of 440 metres (approximately one city block) and walking on-the-spot for two minutes. The walk might be similar in effort to a brisk walk to post a letter or visit a store.

The suppleness measures include standing and raising one arm over your head, standing and bending sideways at the waist, standing and turning sideways at the waist and sitting and bending forward at the waist. These movements are simple, everyday actions and will be measured within your normal range of motion. In other words, the subject will perform each movement in a comfortable fashion, without straining. The effort involved would be similar to reaching for a high shelf at home or bending over to tie one's shoes.

The strength and endurance measures include curl-ups and modified push-ups. "How To" instructions will be provided for

these items prior to testing. Physical effort is required to perform curl-ups and modified push-ups, however, careful self-monitoring of the body's traffic signals listed below will enable the subject to train in their personal comfort zone.

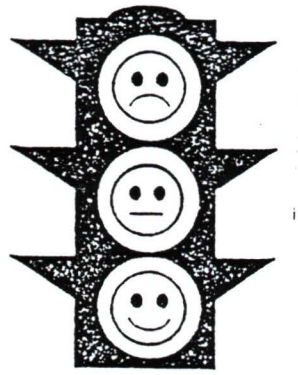
The traffic signals below are the guidelines for all of the exercises described above. The participant is to stay within in the "Green Light Zone" at all times while performing the activities involved in the test situation as well as all exercises and activities completed in the subject's personal exercise/activity program.

Red light = STOP!
- Out of breath
- Muscles straining
- Feeling exhausted

Amber light = CAUTION!
- Short of breath
- Muscles tiring
- Feeling tired

Green light = GO!
- Comfortable breathing
- Good muscle tension
- Feeling good

By obeying your body's traffic signals, you can safely monitor your own exercise program.



Participation in this research project should be an interesting, fun experience for all concerned. The voluntary nature of this program allows each subject to participate at his\her own level and, if desired, to withdraw at any time.

I, _____ declare _____

to be medially fit to participate in this research project.

Date: _____

Sincerely,

Dr. R.D. Bell
Principle Investigator

Tessa Graham
Research Assistant

APPENDIX D

Activity Appraisal Questionnaire

Name: _____ Subject No: _____

ACTIVITY APPRAISAL QUESTIONNAIRE

Please indicate the number of hours per day you spend doing the following activities.

HOURS PER DAY

DAILY ACTIVITY	> 1	1 to 2	2 to 4	4 to 8	8+
Sitting (t.v.)					
Walking					
Heavy Lifting					

Please indicate the number of hours per week you spend on the following activities. Also indicate how many weeks of the year you participate in these activities.

HOURS PER WEEK

LEISURE TIME	Weeks/ Year	>1	1 to 2	2 to	4 to 8	8+
Jogging						
Walking						
Golf						
Curling						
Dancing						
Bowling						
Group Fitness						
Skating						
Skiing						
Bicycling						
Racquet Sports						
Swimming						
Mowing/Raking						
Individual Ex.						
Other(describe)						

APPENDIX E

Self-Evaluation of Life Function (SELF) Scale

Project B: SELF - Self-Evaluation of Life Function Questionnaire

Name:_____ Date:_____ Subject No:_____

Directions: Please answer the following questions by *circling* the appropriate number.

1. How has your health been over the *past month*?
   1. Very good
   2. Good
   3. Poor
   4. Very poor

2. How much physical pain have you had over the *past month*?
   1. None
   2. Mild pain
   3. Moderate pain
   4. Considerable pain

3. How often do you see your friends and relatives?
   1. Often (daily or several times a week)
   2. Occasionally (about once a week)
   3. Infrequently (few times a month)
   4. Rarely or never

4. How often have you made telephone calls over the past month?
   1. Several times a day
   2. Daily
   3. Not every day, but at least weekly
   4. Rarely or never used the phone

5. How often have you worked on a hobby or some activity of interest over the last month?
   1. Often
   2. Occasionally
   3. Infrequently
   4. Not at all

6. How often have you attended meetings at associations, church, organizations, get-togethers, or clubs over the past month?
   1. Often (several time a week)
   2. Occasionally (weekly)
   3. Seldom (once during the month)
   4. Rarely or never

Please show how much the following symptoms have bothered you in the *past month* by circling the appropriate number to the right of each symptom?

		Not at all	A little	Quite a bit	Extremely
7.	Nervousness shakiness inside	1	2	3	4
8.	Feeling low in energy or slowed down	1	2	3	4
9.	Trembling	1	2	3	4
10.	A feeling of being trapped or caught	1	2	3	4
11.	Feeling lonely	1	2	3	4
12.	Heart pounding or racing	1	2	3	4
13.	Trouble getting your breath	1	2	3	4
14.	Feeling blue	1	2	3	4
15.	Soreness of your muscles	1	2	3	4
16.	Numbness or tingling in parts of your body	1	2	3	4
17.	Heavy feelings in your arms or legs	1	2	3	4
18.	Feeling hopeless about the future	1	2	3	4
19.	Weakness in parts of your body	1	2	3	4

Please read the statements below and indicate whether or not you agree with the statement by circling the appropriate number to the right of each statement.

	Strongly Agree	Agree	Disagree	Strongly Disagree
20. I worry about my physical health.	1	2	3	4
21. These are the best years of my life.	1	2	3	4
22. I feel that I have a number of good qualities.	1	2	3	4
23. Becoming a success is a matter of hard work; luck has little or nothing to do with it.	1	2	3	4
24. I am just as happy as when I was younger.	1	2	3	4
25. When I think about the kind of person I have been in the past, it doesn't make me feel very happy or proud.	1	2	3	4
26. What happens to me is my own doing.	1	2	3	4
27. Life has meaning to me.	1	2	3	4
28. Most people don't realize the extent to which their lives are controlled by accidental happenings.	1	2	3	4
29. This is the dreariest time of my life.	1	2	3	4
30. Many times I feel that I have little influence over the things that happen to me.	1	2	3	4

	Strongly Agree	Agree	Disagree	Strongly Disagree
31. I take a positive attitude toward myself.	1	2	3	4
32. I have enough work activities or chores to do during the day.	1	2	3	4
33. I get a sense of satisfaction out of work activities or chores I do.	1	2	3	4
34. In almost every respect, I am very glad to be the person I am.	1	2	3	4
35. Thinking back, in a good many ways I don't think I have liked myself very much.	1	2	3	4
36. I wish I could have more respect for myself.	1	2	3	4
37. The things I do are as interesting to me as they ever were.	1	2	3	4
38. I feel that I am a person of worth, at least on an equal basis with others.	1	2	3	4
39. My life could be happier than it is now.	1	2	3	4

40. Please circle any of the following medications you are *currently* taking.

1.	Arthritis medication	12.	Antibiotics
2.	Pain killers	13.	Thyroid pills
3.	Sleeping pills	14.	Seizure pills
4.	Allergy pills	15.	Chest pain pills
5.	High blood pressure pills	16.	Water pills
6.	Pills for diabetes	17.	Laxatives
7.	Heart pills	18.	Blood thinner med.
8.	Insulin	19.	Pills for breathing
9.	Stomach medication	20.	Circulation pills
10.	Tranquilizers	21.	Other (list) _____
11.	Cortisone		

41. Please circle any of the following conditions your doctor has told you that you *currently have at this time*.

1.	Heart Condition	12.	Liver disease
2.	Circulation problems	13.	Kidney disease
3.	High blood pressure	14.	Urinary problems
4.	Anaemia	15.	Parkinson's disease
5.	Diabetes	16.	Stroke
6.	Emphysema/bronchitis	17.	Arthritis
7.	Cataracts	18.	Emotional problems
8.	Stomach ulcers	19.	Skin problems
9.	Broken bones	20.	Cancer
10.	Gall bladder problems	21.	Other (list) _____
11.	Hernia		

APPENDIX F

Warm-Up

WARM-UP EXERCISES FOR POST 50 TEST

1. Walking on the spot and gently swinging arms by side (2 minutes).

2. Trunk Rotation - Hands on waist. Standing with feet shoulder width apart, slowly turn from side to side. Hold 15 seconds - twice each side.

3. Side Stretch - Hands by side. Slowly slide hand down one side of leg, while holding onto corner of wall with other hand. Hold 15 seconds, twice each side.

4. Calf Stretch - Elbows on wall. Slowly more hips toward wall until feel stretch in lower leg. Hold 15 seconds - twice each side.

APPENDIX G

Post 50 Physical Performance Test

Post 50 "3-S" Physical Performance Test

STAMINA TESTS

There are two stamina tests. These include, a Two Minute On-The-Spot Walk, and a 400 meter (440 yards) Brisk Walk (400 meters is approximately equal to the distance around one city block).

STAMINA TEST #1

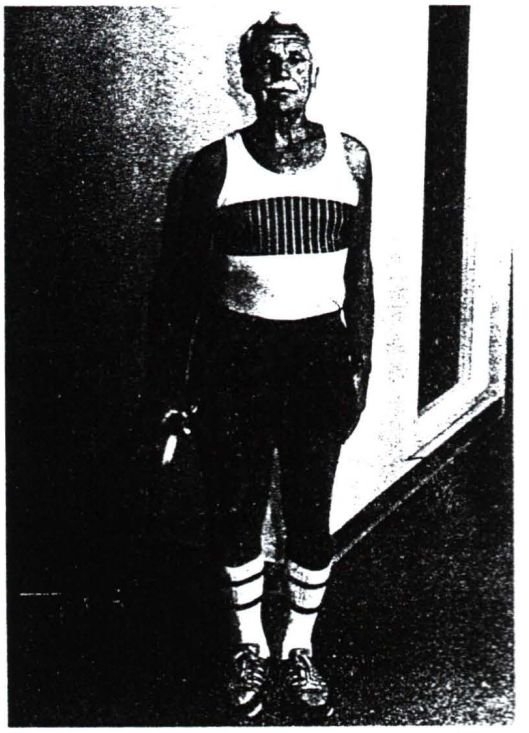
Two Minute On-the-Spot Walk

Use the back of a chair or some other stable object for support, and use a watch with a sweep hand or a stop watch to keep track of the time for the walk.

For two minutes, walk briskly on-the-spot, raising knees alternately to hip level. Start by lifting the right foot first.

Count the number of times the left foot contacts the floor in two minutes.

Remember! Obey the body's traffic signals and stay "In the Green"!



Starting Position

Action

SCORING

Record the **number of left foot floor contacts** on the Post 50 "3-S" Test Results form at the end of this chapter.

To obtain your **stamina rating**, simply compare your score with those in the appropriate table for your age and gender.

Record your stamina rating on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES - Number of Steps

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-60	0-55	0-33	0-31
BELOW AVERAGE	61-75	56-68	34-57	32-53
GOOD	76-96	69-90	58-79	54-66
EXCELLENT	97+	91+	80+	67+

TABLE FOR MALES - Number of Steps

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-67	0-57	0-50	0-50
BELOW AVERAGE	68-85	58-78	51-75	51-70
GOOD	86-100	76-96	76-92	71-87
EXCELLENT	101+	97+	93+	88+

Post 50 "3-S" Physical Performance Test

STAMINA TEST #2

400 meter (440 yard) Brisk Walk

Use a watch with a sweep hand or a stop watch to keep track of the time for the 400 meter walk. Note the time at the start of the walk.

Walk briskly, with a normal arm swing for a distance of 400 meters (440 yards).

Note the time at the end of the walk.

Starting Position

Keep your body's traffic signal "In the Green" at all times!

Action

SCORING

Record the **time in minutes and seconds** that it takes you to complete the walk on the Post 50 "3-S" Test Results form at the end of this chapter.

To obtain your **stamina rating**, simply compare your score with those in the appropriate table below for your age and gender. Record your stamina rating on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Length of Time

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	5:06+	5:43+	7:01+	8:51+
BELOW AVERAGE	5:05-4:15	5:42-4:37	7:00-5:30	8:50-6:20
GOOD	4:14-3:56	4:36-4:17	5:29-4:57	4:56-0
EXCELLENT	3:55-0	4:16-0	4:56-0	5:09-0

TABLE FOR MALES – Length of Time

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	5:09+	5:09+	5:40+	8:50+
BELOW AVERAGE	5:08-4:12	5:08-4:15	5:39-4:31	8:49-5:55
GOOD	4:11-3:46	4:14-3:46	4:30-3:55	5:54-4:48
EXCELLENT	3:45-0	3:45-0	3:54-0	4:47-0

Post 50 "3-S" Physical Performance Test

MUSCULAR STRENGTH & ENDURANCE ITEMS

There are two muscular strength and endurance tests. These include curl-ups for one minute, and modified push-ups for one minute.

MUSCULAR STRENGTH & ENDURANCE TEST #1

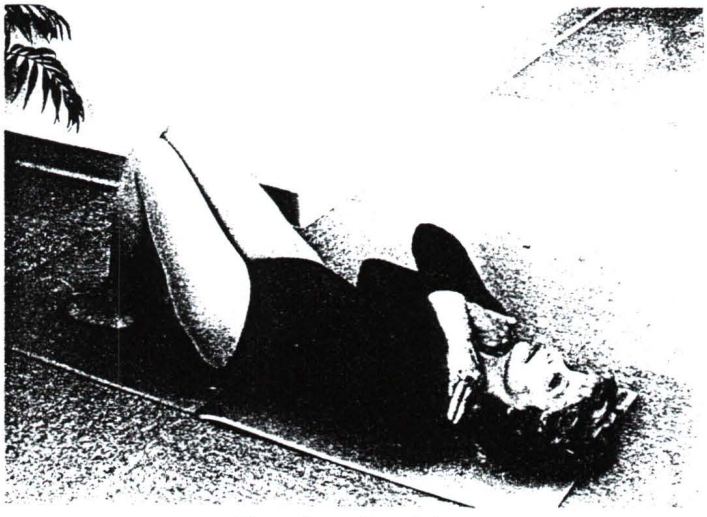
CURL-UPS

For comfort, do this test on a mat or carpeted floor area. Lie on your back with knees bent and feet resting flat on the floor. Place your left hand on your right shoulder and your right hand on your left shoulder.

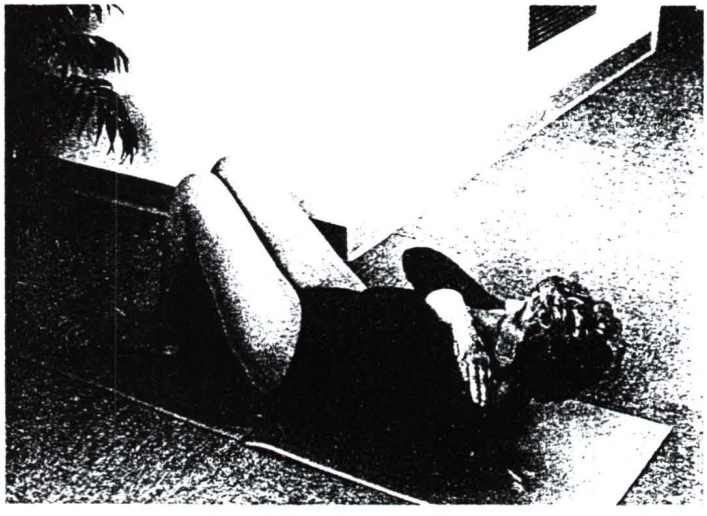
To do a curl-up, lift your head, tuck your chin to chest and raise shoulders and upper back in a curling-up motion until your shoulder blades are off the floor.

A completed curl-up is one up-down movement. Count the number of completed curl-ups in one minute.

CAUTION! Do not hold your breath! Breathe out as you curl-up, and breathe in as you uncurl.



Starting Position



Curl-Up Position

SCORING

Record the **number of curl-ups** you do in one minute on the Post 50 "3-S" Test Results form at the end of this chapter.

To obtain your **muscular strength and endurance rating**, simply compare your score with those in the appropriate table for your age and gender.

Record your muscular strength and endurance rating on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Number of Curl-Ups

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-5	0	0	0
BELOW AVERAGE	6-15	1-8	1-2	0
GOOD	16-26	9-20	3-15	1-9
EXCELLENT	27+	21+	16+	10+

TABLE FOR MALES – Number of Curl-Ups

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-13	0-6	0	0
BELOW AVERAGE	14-20	7-15	1-10	1-4
GOOD	21-34	16-30	11-25	5-19
EXCELLENT	35+	31+	26+	20+

Post 50 "3-S" Physical Performance Test

MUSCULAR STRENGTH & ENDURANCE TEST #2

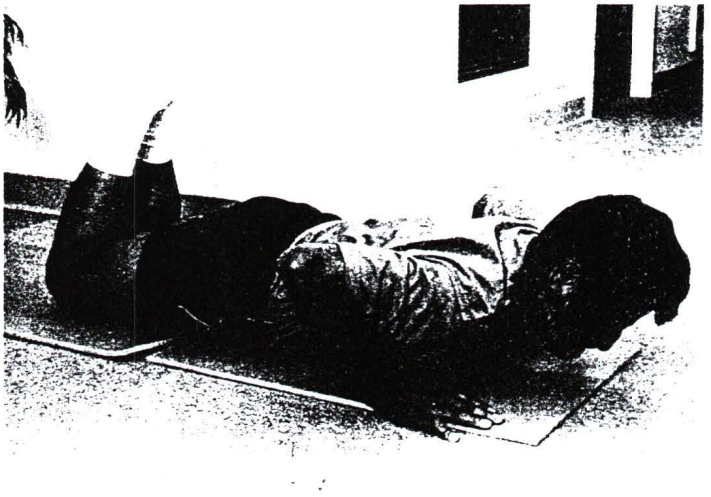
Modified Push-Ups

For comfort, do this test on a mat or carpeted floor area. Lie on your stomach, knees bent with feet as close to buttocks as possible. Place hands on floor with the right hand under the right shoulder and the left hand under the left shoulder.

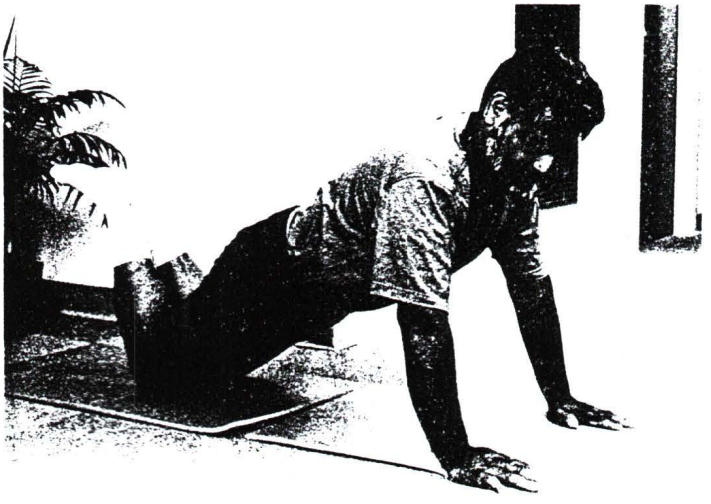
To do a push-up, keep a straight line from shoulders to knees while you straighten your arms and raise your body so that only your hands and knees are in contact with the floor.

A completed push-up is one up-down movement. Count the number of completed push-ups in one minute.

CAUTION! Do not hold your breath! Breathe out as you push-up, and breathe in as you lower back to the starting position.



Starting Position



Push-Up Position

SCORING

Record the **number of push-ups** you do in one minute on the Post 50 "3-S" Test Results form at the end of this chapter.

To obtain your **muscular strength and endurance rating**, simply compare your score with those in the appropriate table for your age and gender.

Record your muscular strength and endurance rating on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Number of Push-Ups

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-2	0	0	0
BELOW AVERAGE	3-13	1-7	1-3	0
GOOD	14-20	8-16	4-13	1-7
EXCELLENT	21+	17+	14+	8+

TABLE FOR MALES – Number of Push-Ups

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	0-12	0-7	0	0
BELOW AVERAGE	13-21	8-16	1-10	1-4
GOOD	22-31	17-25	11-19	5-12
EXCELLENT	32+	26+	20+	13+

SUPPLENESS TEST ITEMS

There are three suppleness tests. These include right and left shoulder flexion, right and left trunk lateral flexion, and, sit-and-reach.

SUPPLENESS TEST #1

Right Shoulder Flexion

Stand with your back to a wall, at the junction of an outside right angle corner. Place feet together with heels, buttocks, shoulders (right shoulder is just passed the corner), and head against the wall. Both arms are straight and hands face towards sides. Keep your right arm straight and raise it to the front as high as is comfortably possible. Note the position of your straight right arm at full flexion in relation to the ***Body Landmarks*** and ***Letter References*** listed on the opposite page.

Left Shoulder Flexion

Stand with your back to a wall, at the junction of an outside right angle corner. Place feet together with heels, buttocks, shoulders (left shoulder is just passed the corner), and head against the wall. Both arms are straight and hands face towards sides. Keep your left arm straight and raise it to the front as high as is comfortably possible. Note the position of your straight left arm at full flexion in relation to the ***Body Landmarks*** and ***Letter References*** listed on the opposite page.

Left Shoulder Starting Position

Left Shoulder Flexion

SCORING

Record the **Letter References** for the right and left shoulder flexion movements on the Post 50 "3-S" Test Results form at the end of this chapter.

BODY LANDMARK.....LETTER REFERENCE
Arm Below Horizontal .....A
Arm Above Horizontal but Below Eye Level.....B
Arm Between Eye Level and Vertical.....C
Arm At Vertical .....D
Arm Past Vertical .....E

To obtain your right and left **shoulder flexion ratings**, simply compare your letter references with those in the appropriate table for your age and gender.

Record your left and right shoulder flexion ratings on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Shoulder Flexion

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A, B	A
BELOW AVERAGE	C	C	C	B
GOOD	D	D	D	C
EXCELLENT	E	E	E	D, E

TABLE FOR MALES – Shoulder Flexion

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A, B	A
BELOW AVERAGE	C	C	C	B
GOOD	D	D	D	C
EXCELLENT	E	E	E	D, E

SUPPLENESS TEST #2

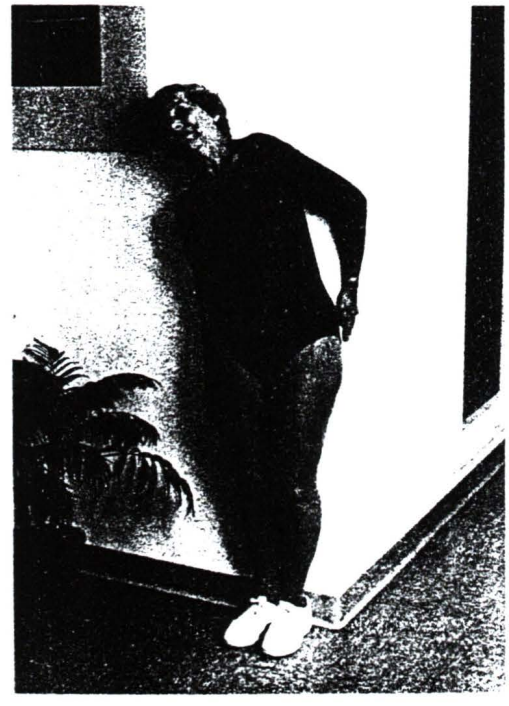
Trunk Lateral Flexion Right

Stand with your back to a wall, at the junction of an outside right angle corner. Place feet together with heels, buttocks, shoulders (left shoulder is even with the edge of the corner), and head against the wall. Both arms are straight with the right hand resting against the right leg and the left hand on the corner of the wall. Use the left hand to keep your hips from moving. With the palm of your right hand facing your body, bend sideways at the waist to the right, sliding your right hand down your leg as far as comfortably possible. Note(feel and look!) the position of the fingertips of your right hand in relation to the ***Body Landmarks*** and ***Letter References*** listed on the opposite page.

Trunk Lateral Flexion Left

Stand with your back to a wall, at the junction of an outside right angle corner. Place feet together with heels, buttocks, shoulders (right shoulder is even with the edge of the corner), and head against the wall. Both arms are straight with the left hand resting against the left leg and the right hand on the corner of the wall. Use the right hand to keep your hips from moving. With the palm of your left hand facing your body, bend sideways at the waist to the left, sliding your left hand down your leg as far as comfortably possible. Note (feel and look!) the position of the fingertips of your left hand in relation to the ***Body Landmarks*** and ***Letter References*** listed on the opposite page.

Starting Position - Right



Flexed Position - Right

SCORING

Record the **Letter References** for the right and left trunk lateral flexion movements on the Post 50 "3-S" Test Results form at the end of this chapter.

BODY LANDMARK.....LETTER REFERENCE
Fingertips Above Knee Cap .....A
Fingertips At The Top Of Knee Cap .....B
Fingertips At The Upper Half Of Knee Cap C
Fingertips At The Lower Half Of Knee Cap....D
Fingertips Below Knee Cap .....E

To obtain your right and left **trunk lateral flexion ratings**, simply compare your letter references with those in the appropriate table for your age and gender.

Record your left and right trunk lateral flexion ratings on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Lateral Flexion

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A, B	A
BELOW AVERAGE	C	C	C	B
GOOD	D	D	D	C
EXCELLENT	E	E	E	D, E

TABLE FOR MALES – Lateral Flexion

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A	A
BELOW AVERAGE	C	C	B	B
GOOD	D	D	C	C
EXCELLENT	E	E	D, E	D, E

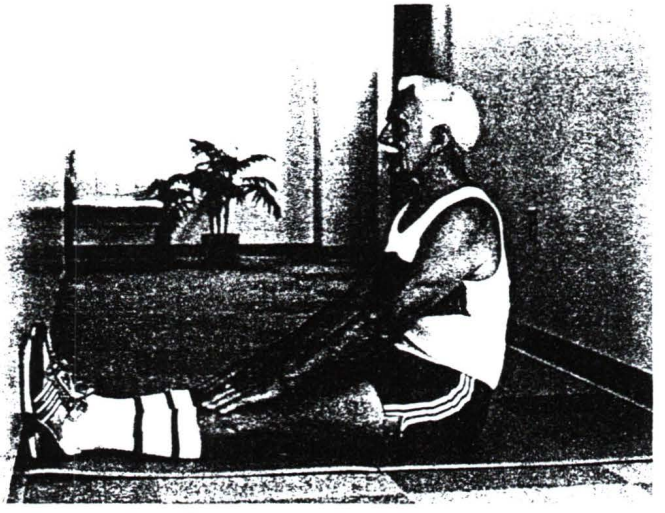
SUPPLENESS TEST #3

SIT-AND-REACH

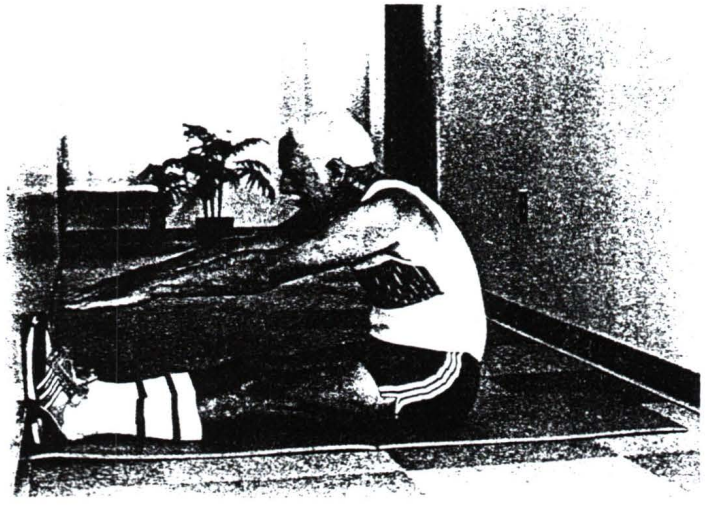
Sit with your legs as straight as comfortably possibly, your feet together and placed flat against a wall.

Keep your back straight and slowly slide your hands forward down the front of your legs as far as possible towards your feet.

Note the position of the fingertips in relation to the ***Body Landmarks*** and ***Letter References*** listed on the opposite page.



Starting Position



Reach Position

SCORING

Record the **Letter Reference** for the sit-and-reach movement on the Post 50 "3-S" Test Results form at the end of this chapter.

BODY LANDMARK.....LETTER REFERENCE
Fingertips On Top Half Of Shin .....A
Fingertips On Bottom Half Of Shin .....B
Fingertips Beyond The Ankle C
Fingertips At Toes .....D
Fingertips Past Toes .....E

To obtain your **sit-and-reach rating**, simply compare your letter reference with those in the appropriate table for your age and gender.

Record your sit-and-reach rating on the Post 50 "3-S" Test Results form at the end of this chapter.

TABLE FOR FEMALES – Sit & Reach

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A, B	A
BELOW AVERAGE	C	C	C	B
GOOD	D	D	D	C
EXCELLENT	E	E	E	D, E

TABLE FOR MALES – Sit & Reach

AGE	50-64	65-74	75-85	85+
NEED TO IMPROVE	A, B	A, B	A	A
BELOW AVERAGE	C	C	B	B
GOOD	D	D	C	C
EXCELLENT	E	E	D, E	D, E

APPENDIX H

"Daily Dozen"

RECIPES FOR SUPPLENESS

The loss of suppleness with age is very pronounced. This loss is even more pronounced for men than for women. The Daily Dozen is a general suppleness recipe that will help maintain mobility in the major joints of your body.

A. THE DAILY DOZEN

Ingredients	Amount	"How-To" Reference Page
Head Turn	3x	Page 150
Arm Across	3x	Page 168
Wrist & Finger Flex	3x	Page 172
Chair Reach	3x	Page 169
Side Reach	3x	Page 155
Knee-Ups	3x	Page 158
Counter Hang	3x	Page 176
Trunk Bow	3x	Page 179
Groin Stretch	3x	Page 160
Stair Step	3x	Page 182
Thigh Stretch	3x	Page 162
Wall Lean	3x	Page 180

Mixing Instructions

Do the set of 12 static stretching exercises in order. Do the set of 12 static stretching exercises a second and third time.

Cooking Time

20 minutes any time you wish, each and every day.

APPENDIX I

"Upper Body Builder"

B. THE UPPER BODY BUILDER

Ingredients	Amount	"How-To" Reference Page
Generic Warm-up	10 min.	Page 186
Finger Flex	10x	Page 110
Arm Curls (Front)	10x	Page 116
Wall Push-Ups	10x	Page 140
Arm Raises (Side)	10x	Page 92
Modified Push-Ups	10x	Page 88
Generic Cool-Down	10 min.	Page 187

Mixing Instructions

Do the set of 5 muscular strength and endurance exercises in order. Do the set of 5 strength and endurance exercises a second time before beginning your cool-down.

Mixing Caution

Perform all exercises slowly and deliberately. Never hold your breath!

Cooking Time

Cook for 30 minutes, twice each week with 2 days rest between.

APPENDIX J

The Exercise Walk

Recipes That Work

RECIPES FOR STAMINA

The stamina activity of choice for most people over 50 years of age is walking. The Exercise Walk is, therefore, an important recipe.

A. THE EXERCISE WALK

Ingredients	Amount	"How-To" Reference Page
Warm-Up	5 min.	Page 186
Brisk Walk	25 min.	
Cool-Down	5 min.	Page 187

Mixing Instructions

After the static stretching portion of your warm-up, ease into the brisk walking pace with 5 minutes of slower paced walking. Begin your cool-down by continuing to walk for an additional 5 minutes at a slow pace before doing the static stretching.

Cooking Time

Cook for 30 minutes, at least 3 times a week, with at least 1 day of rest between.

APPENDIX K

Activity Log

Name:_____ **Subject No:**_____

ACTIVITY LOG

To help us monitor your level of additional activity, please record any activity in which you participate and the date.

DATE	ACTIVITY DESCRIPTION & TIME SPENT
Eg. July 20/91	Brisk morning walk 45 minutes

VITA

SURNAME: Graham **GIVEN NAMES:** Tessa Rae

PLACE OF BIRTH: Moscow, Idaho, USA

DATE OF BIRTH: May 2, 1966

EDUCATIONAL INSTITUTIONS ATTENDED:

University of Victoria 1985-1986, 1987-1992

DEGREES AWARDED:

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University of Victoria

Master of Arts Degree, Physical Education 1992
University of Victoria

AWARDS:

University of Victoria Graduate Fellowship 1991-92
B.C. Recreation and Parks Association 1991
Outstanding Student Award

University of Victoria Faculty Scholarship 1990
University of Victoria Alumni Scholarship 1990
Physical Education Scholarship 1990

University of Victoria Faculty Scholarship 1989
University of Victoria President's Scholarship 1989
Physical Education Scholarship 1989
Frank and Margaret Gibbs Scholarship 1989

University of Victoria President's Scholarship 1988
Physical Education Scholarship 1988
Rosalind W. Young Scholarship 1988

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Title of Thesis: The Effect of Prescribed and Self-Prescribed, Self-Monitored Exercise Programs on the Physical Fitness and Psychological Well-Being of Older Adults

Author: [redacted]

TESSA RAE GRAHAM

July 2, 1992