1994

A freehand strength training book for older adults

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Orr, Timothy Alan, M.A.

San Jose State University, 1994

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**300 N. Zeeb Rd.
Ann Arbor, MI 48106**

A FREEHAND STRENGTH
TRAINING BOOK FOR
OLDER ADULTS

A Project

Presented to

The Faculty of the Department of Human Performance
San Jose State University

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

By

Timothy Alan Orr

May 1994

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Timothy Alan Orr

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ABSTRACT

REST NOT RUST NOT STRENGTH TRAINING FOR OLDER ADULTS

by Timothy Alan Orr

The growing number of Americans, 65 years of age and above, has led some in the health and fitness profession to create exercise programs with the goal of enhancing the quality of life of the elderly.

Loss in muscular strength has been found to be a seriously limiting factor for older adults. Without sufficient muscular strength the aged can not open jars, climb stairs, get out of chairs, or carry grocery bags. Thus, an important component of older adult physical fitness training should be muscular strength development and maintenance. However, not all older adults have access to gymnasium equipment. Therefore, the purpose of this project was to create and evaluate a book outlining an exercise program for older adults (65 years and older) that uses the exerciser's body weight as resistance in a strength training program.

Evaluation responses were favorable and indicate that this project was a success in terms of educational quality and exercise instruction.

Acknowledgements

I would like to dedicate this project to my parents, Betty and Alan, without whose patience, support, and encouragement none of this would have been possible.

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CHAPTER I

Introduction

As we enter the 21st Century, one of the most pervasive trends is the aging of the American population (Spencer, 1989). This aging phenomenon is occurring as a result of a higher average age at death for American citizens and an increase in the percentage of the total population which is 65 years and older. Life expectancy in the United States has risen by almost 30 years since 1900, when the average age at death was 45 years (Stamford, 1984). This societal aging has existed in America since the latter half of the nineteenth century. In 1870, for example, 1.2 million Americans, or 3% of the population, were 65 years of age or older. By the early 1980's that number had risen to 11% (Lewis, 1984). Current census projections indicate an increase of 4 million people 65 years of age and above between 1987 and 1995. After 2010, this age group will experience an even greater increase in total numbers to 52 million in 2020, 65.6 million in 2030, and 114 million in 2080. The proportion of the entire U.S. population that is 65 years and older is projected to increase from 12.2% in 1987 to 13.0% in 2000, 21.8% in 2030, and 24.5% by

2080 (Spencer, 1989). The age group 65 and over is expected to grow very rapidly to 52 million in 2020 and 65.6 million in 2030 as post-World War II baby boomers reach old age (Spencer, 1989).

Interestingly, the population aged 85 years and above is predicted to grow even more rapidly than the over 65 years group. This will result as the very old reap the greatest benefits from future improvements in lifespan extension (Spencer, 1989). Currently, there are approximately 2.9 million Americans aged 85 years and above; by 2000 that number will reach 4.6 million, 8 million by 2030, and 15 million by 2080 (Spencer, 1989).

Typically, human aging has meant retiring, slowing down, and settling into a dependent, passive lifestyle (Work, 1989). In fact, at least 75% of those people over 65 years of age suffer one or more physically limiting conditions including, heart disease, arthritis and rheumatism, and visual impairments (Lewis, 1984). In the past few years intense research has been devoted to studying the aged and the impact their growing numbers have on Medicaid expenditures for nursing homes. The 1977 National Nursing Home Survey determined that approximately 22% of the

very old (85 years and above) reside in nursing homes. If this rate continues, the increasing numbers of old people will create an additional \$6.3 billion (1982 dollars) in annual Medicaid nursing home payments by the year 2012 (Ray, Federspiel, Baugh, & Dodds, 1987).

Research shows that as a person ages there is a general decline in work capacity, muscle strength and size, maximum cardiac output, and the function of many organ systems (Stamford, 1984). Of these declines the one that most dramatically affects an elderly person's ability to remain active and independent is muscle strength (Flatten, 1982). For example, recent studies have shown an association between lower body muscle weakness and falling frequency in people 65 years of age and over. These falls can result in fractures, sprains, decreased mobility, and lack of confidence (Work, 1989).

Electromyographical and videotape analysis of older persons (mean age of 75 years) performing routine activities, such as rising from an armchair, shows that the aged require much more physical exertion than younger persons (mean age of 24 years). When rising from a standard armchair, the older subjects had to place their feet farther back and

registered greater vastus lateralis muscle activity than the younger subjects (Wheeler, Woodward, Ucovich, Perry, & Walker, 1984). Tests measuring the muscle strength and flexibility of older adults 60 to 95 years of age showed a significant decline when compared to younger age groups. And, while flexibility decreases impaired physical performance for the elderly, the loss of muscle strength was the most significant factor relative to their daily activities (Flatten, 1982).

Given these findings researchers in recent years have begun to emphasize the merit of improving muscular strength, not merely endurance, in the elderly. The fitness "craze," which concentrates on aerobic fitness, applies more to younger people who are trying to prevent cardiovascular disease. Very old people are not likely to die of heart disease based upon their own longevity. They are more likely to suffer from osteoporosis, hip fractures, and immobility. The inability to get out of a chair or off a toilet, not the inability to run down the street, is inhibiting their lifestyle (Work, 1989).

Since muscle strength is especially important to the aged, recent studies indicating that older adults

respond to strength training programs with improved physical function, greater independence, enhanced confidence, and an improved self-image are encouraging (Work, 1989). Strength training studies on previously untrained elderly individuals conclude that high-resistance strength training leads to significant increases in muscle strength, size, and functional mobility even among frail residents of nursing homes up to 96 years of age (Fiatarone et al., 1990).

Thus, a major goal of physical training for the elderly should be to conserve or build sufficient muscle function. Along with improving locomotion and stability by strengthening the lower body, and increasing manipulation ability by strengthening the upper body, a strength training program for the elderly can help persons with arthritis. Coping with osteoarthritis depends on how the stresses around the joint are shared by the muscle and the capsule tissue. Stronger muscles reduce the stress placed on the joint surface (Fischer, Pendergast, Gresham, & Calkins 1991).

According to the 1989 American College of Sports Medicine guidelines, strength training for the elderly should consist of weight machine work in a gymnasium,

or calisthenics and light weights at home (Work, 1989). The latter alternative is for people who do not have access to a gymnasium. In this case, gerontology exercise experts recommend that senior participants do calisthenics at home for strength training. These routines should consist of 8 to 10 exercises that cover the major muscle groups including the back, chest, trunk, thigh, and leg muscles (Work, 1989).

Purpose

The purpose of this project is to create and evaluate a book outlining an exercise program for older adults (65 years and older) that uses the exerciser's body weight as resistance in a strength training program. This project is designed to provide an alternative strength training program for older adults who either do not have access to gymnasium equipment, or do not desire to join a gym.

Limitations

This book will be limited as follows:

(a) the usefulness of the book will be dependent upon the number of older individuals concerned with physical training, (b) also, sufficient participant motivation, which must partially be generated by the

book, is critical for the effectiveness of the program, and (c) some participants may be discouraged initially due to their inability to perform even one repetition of an exercise. Also, the availability of the book to older adults in terms of store cost or library access are potential limitations.

The evaluation of the book also faces limitations: (1) some evaluators may have lost their motivation and not completed the forms, and (b) likewise, those who did complete the evaluation process may have been biased in favor of the book, since they were interested enough to complete the reading and evaluation.

Hypotheses

The following hypotheses are established for this project: (a) the book will be deemed effective based upon the responses of an expert group and a general population group to a Likert-type rating scale, and (b) there will be an appreciable educational benefit for older adults demonstrated by the difference between the pre- and post-test scores on an educational test administered to the older subjects.

Definitions

Elderly - "The point at which it is normal to cease full-time employment, 65 years of age for people in North America" (Work, 1989, p.135).

Freehand Exercise - Freehand exercises are non-apparatus movements which use the participant's body weight as resistance in strength training (Schwarzenegger & Hall, 1977).

Summary

Current census evidence indicates that there is an overall aging of United States citizens and an accompanying increase in nursing home and Medicaid costs. These trends are predicted to continue into the next century with a dramatic rise in the population of Americans 65 years and above and a corresponding increase in Medicaid costs, possibly up 280% from 1982 levels by 2012 (Ray et al., 1987).

Our current mortality improvements are increasing the lifespan of American citizens; but, is a longer life a better life? Or, are we condemning millions of people to decades of expensive nursing home care as Medicaid statistics indicate (Ray et al., 1987)? Many of the physical factors which limit the elderly's ability to function independently within our society

are due to a loss in muscle strength (Fiatarone et al., 1990). Evidence from recent studies shows that the elderly respond with significant gains in muscle strength, size, and function to progressive resistance strength training (Brown, McCartney, & Sale, 1990; Fiatarone, et al., 1990; and Evans, Frontera, Knuttgen, Meredith, & O'Reilly, 1988). The purpose of this project is to create and evaluate a book outlining an exercise program for older adults (65 years and above) that uses the exerciser's body weight as resistance in a strength training program.

CHAPTER II

Literature Review

The purpose of this project was to create and evaluate a strength training book for older adults. The first section in this review of literature focuses upon studies that demonstrate the efficacy of strength training for the elderly with regard to increased muscular strength, muscular hypertrophy, and improved muscle function. Then, a section discussing strength training adaptations for the elderly, such as increased bone mineral content (in older women), improved motor performance and cognitive processing speed, and improved joint mobility for arthritis sufferers is presented. In the third section are discussed the effects of exercise on older adult self-esteem. This will be followed by a review of three fitness books which contain strength training regimes using the exerciser's body weight as resistance. This chapter will conclude with a summary.

Muscle Properties

Surveys throughout the United States have shown that after the age of 74 years, 28% of men and 66% of women cannot lift objects weighing greater than 4.5 kilograms--approximately 10 pounds (Jette, 1981).

However, in a recent study positive adaptations to weight-lifting training in the elderly were examined. In particular, these researchers focused upon isometric strength, isokinetic torque, whole muscle and individual fiber cross-sectional areas, and muscle-evoked contractile properties. Subjects consisting of fourteen healthy 60 to 70 year old male volunteers, without prior weight-lifting experience, were studied performing bilateral leg press, supine bench press, seated deadlift, bent leg abdominal curls, and arm curls on a specially built apparatus to enable one-arm curls allowing a within-subject control. Training was performed on three alternate days each week for twelve weeks (Brown et al., 1990).

Dynamic elbow flexion training of one arm resulted in a 48% mean increase in the maximal load that could be lifted once and smaller improvement in isokinetic torque (8.8%). Bilateral leg press training evoked mean increases of 17% and 23% in isokinetic torque and dynamic lifting capacity, respectively (Brown et al., 1990).

The mean maximal cross-sectional area of the elbow flexors (biceps brachii and brachialis) increased by 17.4% in the trained arm but did not

change in the control arm. This study therefore demonstrated that older males can respond to strength training with increases in whole muscle fiber size, as well as increases in muscle strength. In particular, this evidence raises the encouraging prospect that the rate of decline in strength in old age can be reduced or even reversed with appropriate strength building programs (Brown et al., 1990).

A 1988 study also examined older men and skeletal muscle changes following a strength training program. Twelve healthy untrained elderly male volunteers between 60 and 72 years of age participated in the twelve week training program three days a week. Weekly measurements of one repetition maximum demonstrated a progressive increase in strength in knee extensors and flexors. By the twelfth week the extensor and flexor strength had increased an average of 107.4% and 226.7%, respectively. Biopsies of the vastus lateralis muscle showed increases in type I fiber area (slow twitch) of 33.5% and type II fiber area (fast twitch) of 27.6%. Muscle hypertrophy was also accompanied by an increase in the rate of actomyosin protein turnover, as indicated by the urinary excretion analysis of 3-methyl-L-histidine.

Thus, this study demonstrated that a vigorous strength training program can cause a marked gain in muscular strength in older men. Also, the capacity for increasing muscle mass is retained in old age and the associated improvement in muscle strength is partly due to muscular hypertrophy (Frontera et al., 1988).

In a 1985 study designed to compare the effects of isometric strength training of the nondominant left abductor digiti minimi muscles between young and aged women, ten young women (mean age 22.6 years) and ten older women (mean age 69.2 years) participated in a strength training program. The training regimen consisted of 20 maximal isometric contractions of the left abductor digiti minimi three times a week for six weeks. The final results of the six weekly measurements showed no statistically significant differences between the young and older women's strength gains (Kauffman, 1985).

In a study focusing on high intensity strength training in nonagenarians, 10 frail, institutionalized volunteers 90 +/- 1 years participated in 8 weeks of resistance training. Initial one repetition maximum lifts were used to set the load for the first week at 50%. Three times a week the subjects performed three

sets of eight repetitions of knee extensions on a weight and pulley machine. The resistance load was eventually increased to 80% for each subject based upon tolerance (Fiatarone et al., 1990).

Strength gains averaged 174% $\pm$ 31% (mean $\pm$ SEM) in the 9 subjects who completed training. Midthigh muscle area increased by 9.0% $\pm$ 4.5%, and walking speed also improved by 48% following training. The researchers concluded that high resistance weight training leads to substantial increases in muscle strength, size, and functional mobility among frail residents of nursing homes up to at least 96 years of age (Fiatarone et al., 1990).

Although the bulk of the research on elderly strength training adaptations has been conducted on older men with the results generalized to older women, there are some studies which evaluated women subjects specifically. One such study was designed to determine whether increases in muscle strength are associated with changes in cross-sectional fiber area of the vastus lateralis muscle. The 27 subjects (mean age 69 $\pm$ 1.0 (SE) yr.) were randomly assigned to a control or an exercise group for the 12-week resistance training program. The researchers found strength

increases in all of the exercise participants. They concluded that a program of resistance exercise can be safely carried out by elderly women with significant increases in muscular strength partly due to muscle hypertrophy (Charette et al., 1991).

Bone Mineral Content

A study investigating the effects of exercise on bone mineral content in post-menopausal women yielded some positive results. Several previous studies suggest that physical activity is positively related to bone density and may, therefore, be an important factor in the prevention or treatment of osteoarthritis. These studies set the precedent for the current research (Rikli & McManis, 1990).

The purpose of their study was to test the effects of a 10-month exercise program on bone mineral content (BMC) and bone mineral content/bone width (BMC/BW) of post-menopausal women. Thirty-one women (ages 57-83 years) completed either a general aerobics exercise program ($n = 10$), a general aerobics exercise program plus upper body weight resistance strength training ($n = 10$), or served as non-exercising control subjects ($n = 11$). All subjects were pre- and post-

tested for BMC and BMC/BW in the radii of the non-dominant forearm (Rikli & McManis, 1990).

The exercise subjects experienced mean increases of 1.38% and 1.33% in BMC and BMC/BW, respectively, whereas the control group had decreases of 2.50% and 2.58%. The researchers concluded that participation in regular exercise programs has a positive effect on the maintenance of bone mineral content in post-menopausal women. The exercise subjects maintained (and even tended to increase) BMC and BMC/BW throughout the 10 month study, whereas the non-exercising control subjects experienced significant declines. These results indicate that exercise effects do not appear to be limited to specific anatomical sites associated with the location of mechanical loading. Further benefits of specific strength-development exercises may be found to exist if BMC were monitored over a longer (multiyear) period of time (Rikli & McManis, 1990).

In a three year study concluded in 1979, the hypothesis that physical activity and/or supplemental calcium and vitamin D can dramatically slow bone loss and/or increase bone mineral content (BMC) in aged females was tested. Eighty Caucasian females between

69 and 95 years of age were divided into a control group, a drug group (administered Ca and vitamin D), and a physical activity group (Smith, Reddan, & Smith, 1981).

The BMC of the control group declined by 3.29%, while the physical activity group and the drug group yielded a 2.29% and a 1.58% increase, respectively, during the study. The cause of the increased bone mineral content in the physical activity group is likely related to the physical stress placed on the bone. Thus, this study indicates that bone loss in the aged female may be reversed and maintained at a higher level of BMC through physical activity or calcium and vitamin D supplementation (Smith, Reddan, & Smith, 1981).

Motor Performance and Cognitive Processing Speed

Another three year study, this time on the effects of exercise on motor performance and processing speed of previously sedentary older women, was recently conducted. This research evaluated 31 older female volunteers (57-85 years) on choice reaction time (CRT), balance, sit and reach flexibility, shoulder flexibility, and grip strength. The subjects participated three times a week in exercise

performance classes designed to meet American College of Sports Medicine (ACSM) guidelines for improving strength and flexibility (Rikli & Edwards, 1991). The class format consisted of exercises aimed at improving muscular strength such as modified push ups, abdominal curls, leg lifts, and modified squats (Rikli & Edwards, 1991).

From the results of this study it appears that physical activity is effective in reversing, or at least slowing, certain age-related declines in both cognitive and motor performance, particularly as measured by tests involving reaction time, balance and flexibility. The findings of this study indicate that older people with active lifestyles tend to maintain considerably higher levels of performance in muscular strength, balance, and coordination than do sedentary individuals. In addition, these results suggest it may never be too late for sedentary individuals to benefit from exercise participation and reverse certain motor and cognitive performance declines (Rikli & Edwards, 1991).

The relationship between physical fitness and cognitive performance in the aged has been examined in several other studies. According to Chodzko-Zajko

(1991): "cognitive tasks (in the elderly) which require effortful processing should be more sensitive to the effects of fitness than tasks which can be performed without or with minimal attention" (p. 868). Physical exercise contributes to improved cognitive performance in the elderly regardless of education level, which only affected reasoning ability (Clarkson-Smith & Hartley, 1990). Also, the impact of daily physical exercise on cognitively impaired nursing home residents with regard to mobility, balance and urine control was examined. The subjects (15 elderly female patients) were able to walk further, faster, and with greater stability and less incidence of urinary incontinence following physical training (Jirovec, 1991).

Arthritis and Physical Training

A strength training program may also benefit arthritis sufferers. Some experts believe that strength training enables the support tissue of articular joints to absorb more stress. Success in coping with osteoarthritis depends on how the stresses around the joint are shared by the muscle and the capsule tissue. Stronger muscles generally relieve

the entire joint system, including the articular surface, of the forces placed upon it (Work, 1989).

A recent study examined the effect of a muscle rehabilitation program on muscle strength, endurance, speed, and function for patients with osteoarthritis of the knees. Fifteen male subjects with a mean age of 67.6 years plus or minus 6.1 years with osteoarthritis of the knees underwent a four-month exercise program designed to enhance muscle strength, endurance, and speed. After the sixteen week program, there was significant improvement in all three categories, muscle strength increased by 35%, muscle endurance increased by 35%, and muscle speed of contraction increased by 50%. The researchers concluded that the dramatic increase in muscular strength, endurance, and speed was a result of their well-rounded exercise program which included strength training in addition to aerobics. Previous studies which emphasized aerobic training alone showed improvements in muscular endurance but not in muscular strength. The end result of this muscle rehabilitation program was improved overall muscle function and improved knee joint functional performance in spite of osteoarthritis (Fischer et al., 1991).

Without any question an arthritis sufferer needs to develop muscular strength and endurance in order to maintain joint function (McCubbin, 1990). Research shows that training arthritis sufferers effectively counteracts deficits in muscular strength, muscular endurance and joint range of motion (McCubbin, 1990). In addition, general exercise increases natural killer (NK) cell activity and numbers in old and young subjects. NK cell activity helps fortify the immune system in combatting autoimmune diseases such as rheumatoid arthritis and AIDS (Solomon, 1991).

Exercise and Older Adult Psychology

The physiological benefits of exercise for older adults are well documented (Larsson et al., 1984; Meusel, 1984; Nakamura, Moritani & Kanetaka, 1989; Sager, 1983; Smith, Reddan, & Smith, 1981; Stamford, 1984; and Vanfraechem & Vanfraechem, 1977); however, there is also evidence that exercise has a positive affect upon the elderly psyche. According to Bennett, Carmack, and Gardner (1982), physical exercise improves emotional as well as physical well-being by effectively combatting depression. Piscopo (1985) found that exercise provides a "natural way to sustain mental alertness in the aging individual by supplying

oxygen to the brain" (p. 518). Emery and Blumenthal (1990) reported that older adults participating in aerobics and yoga discovered positive changes in many life areas, including cognitive functioning and psychological well-being. Stacey (1985) also found that exercise in persons over 50 may provide benefits which extend to cognitive and personality processes. In a study examining the increased psychosocial benefits of physical activity for women, Wakat and Odom (1982) discovered that older women who participate in physical activity programs not only experience physical benefits, but also experience an increase in self-esteem, increased social contacts, a counteraction to depression, and improved stress management.

Another way to interpret the effects of exercise on older adult psychology is by examining the exercise-aging cycle. According to this model increasing age leads to less exercise which leads to increased body fat, atrophied muscles, less energy, increased anxiety, increased stress, low self-esteem, and depression (Ostrow, 1989). Altering this cycle is possible with a program of regular exercise. Recent studies have shown that physical activities such as weight lifting and running effectively combat anxiety,

low self-esteem, and depression (Doyne, 1987; Monahan, 1986; and Ossip-Klein, 1989). Exercise and high levels of fitness can benefit mood and emotional health and help buffer the effects of stress through improved muscle tone, reduced body fat, and thus produce a more favorable body image which enhances one's self-perception (Tucker, 1990).

Review of Related Exercise Books

The concept of using one's own weight as resistance in a strength training program is not a new one. Several texts have been written which outline freehand or non-apparatus routines, and these include: Working out without weights (Gaylord, 1985), Arnold: The education of a bodybuilder (Schwarzenegger & Hall, 1977), and Maximum muscular fitness: Strength training without equipment (Riley, 1982). These three books can be categorized into two groups: (a) free hand strength training independent of conventional weight resistance training, and (b) free hand strength training as preparation for conventional weight resistance training.

Gaylord's book Working out without weights (Gaylord, 1985) and Riley's book Maximum muscular fitness: Strength training without equipment (Riley,

1982) develop progressive resistance strength training programs independent of weight training. Gaylord, who trained and coached his brother to a gold medal in gymnastics at the 1984 Olympics, writes from the perspective of a gymnast. His program emphasizes strength to weight ratio, muscle flexibility, balance, and improved joint range of motion. The book progresses from basic strength exercises such as push ups, chin ups and squat jumps in the first chapter to more complicated maneuvers such as dips, parallel bar vaults, horizontal bar pullovers, and high ring "iron crosses."

Although the book is intended for fitness-seekers of any age, there is an apparent emphasis placed on youthful, aspiring gymnasts. This fact is evident from the inclusion in the last section of information about seriously pursuing a career in gymnastics. Also, there are no discussions about the physiological mechanisms involved in muscular strength enhancement, or exercise considerations for athletes of various ages in Working out without weights (Gaylord, 1985).

Riley's book Maximum muscular fitness: Strength training without equipment presents a program which develops muscular strength through manual resistance

exercises. Manual resistance is a term Riley uses to refer to resistance provided by a training partner or spotter without exercise equipment (Riley, 1982). For example, this program uses some basic weight resistance exercises such as overhead presses. However, instead of utilizing a barbell, the exerciser pushes against the downward force of his or her training partner. Similarly, with an exercise such as side lateral raises where the performer abducts both arms against the force of dumbbells, with manual resistance the exerciser pushes against the downward force of the training partner.

Riley discusses the advantages and disadvantages of the manual resistance program prior to outlining the entire routine. Under "advantages" he cites that manual resistance offers: no need for exercise equipment, simultaneous participation by large numbers of individuals, maximal muscle work for each repetition, and control of the speed of the exercise. The disadvantages of manual resistance include: the need for two people to perform the exercises, the lifter must learn how to perform each exercise, the spotter must learn how to safely and effectively apply the resistance, the lifter may be significantly stronger

than the spotter, and, finally, one cannot record and evaluate one's strength gains as with a barbell or plate-loading machine (Riley, 1982).

As with Gaylord's book, Riley does not include any information on the physiology of muscular strength acquisition. The book begins with a limited discussion of the history of strength training and the uniqueness of manual resistance conditioning and then proceeds with the exercises. Neither Riley's nor Gaylord's book contains much emphasis on lower body training. In Riley's book six out of the forty exercises presented are designed to strengthen the lower body and with Gaylord's book only two out of thirty-nine emphasize the lower body.

Schwarzenegger and Hall, (1977) book, Arnold: The education of a bodybuilder, contains a section on freehand exercises prior to the introduction of actual weight resistance training. Schwarzenegger recommends using freehand exercises to adequately prepare the body for the rigors of an intensive body building program with weights. His program consists of nine exercises: four for the upper body, three for the abdominals, and two for the thighs, hips, and legs. The entire program is simple and uses such household

items as chairs and books for equipment. The routine is made up of familiar gymnastic exercises such as push ups, chin ups, dips, deep knee bends, and sit ups. Exercise resistance is controlled by how directly load forces (the participant's body weight) are distributed over the working muscles. For example, push up difficulty is increased if the lower body is elevated and decreased if the lower body is lowered - as with kneeling push ups. Unlike Gaylord or Riley, Schwarzenegger includes a discussion on muscle systems and muscle growth, as well as nutrition, in the section prior to the freehand program. Although Schwarzenegger's book is not targeted for a specific age group, there is a slight emphasis placed on readers interested in pursuing a career in bodybuilding. This fact is evident from time lines which appear at the end of each chapter advising readers how long to remain at a given intensity level so as to maximize muscle growth.

Summary

This review of literature contains discussions on the following associated benefits of elderly strength training: increased muscular strength, muscular hypertrophy, and improved muscular function. In this

section evidence is presented which demonstrates that older adults, even in the tenth decade of life, exhibit strength training responses similar to those seen in young adults. This evidence raises the encouraging prospect that the rate of decline in strength in old age can be reduced or even reversed with appropriate strength building programs (Brown et al., 1990).

Several sections in this chapter describe other associated benefits of an older adult strength training program such as increased bone mineral content in older women, improved motor performance and cognitive processing speed, and improved joint mobility for arthritis sufferers. Bone mineral content and motor and cognitive enhancement are achieved as a result of the general effects of exercise on the elderly; however improved physical functioning with arthritis is strongly associated with strength training, since stronger muscles better support the joint capsule. This review also examines the effect that exercise in general has on the psychological state of the elderly. Evidence indicates that older adults who participate in physical activity programs not only experience physical benefits, and experience an increase in

self-esteem and social contacts. Meanwhile stress and depression often decrease (Wakat & Odom, 1982).

Three exercise books are also reviewed in this chapter. Each contains similar free-hand, or non-apparatus, strength training programs as is proposed herein. These three books can be divided into two categories: (a) freehand strength training independent of conventional weight resistance training, and (b) freehand strength training as preparation for conventional weight resistance training.

CHAPTER III

Procedures

This chapter contains a statement of the project's purpose, a description of the project's design, and an overview of the project's evaluation process. In addition, at the end of this chapter is a summary.

The purpose of this project is to create and evaluate a book outlining an exercise program for older adults (65 years and above) that uses the exerciser's body weight as resistance in a strength training program. Although this book addresses technical features of muscular strength training, such as cellular hypertrophy and cellular hyperplasia, the intended audience is the general population of older adults. Therefore the writing style is generally non-scientific. This book includes two introductory chapters: one explaining the benefits of regular exercise for older adults and the other offering guidance in choosing a training program (see Appendix A). This beginning section also includes a discussion of geriatric strength training, current research in elderly strength training, and the physiological characteristics specific to older adults involved in

resistance training. The next section of the book presents four chapters: a warm-up and cool-down chapter, a chapter of beginning level freehand strength training exercises which progress through intermediate and advanced levels. Following the advanced exercise chapter there are some closing comments regarding motivation, diet, body composition, and proper sleep (see Appendix A.)

Evaluation

To evaluate this project a questionnaire with a Likert-type rating system was designed. A panel of eight experts, four men and four women between thirty-three and sixty-five years of age, was selected to review the manuscript. The panel consisted of 3 personal trainers, 2 medical doctors who work with older adults, a sports podiatrist, a senior exercise magazine writer, and a World's Gym owner. Two of the personal trainers have natural science degrees and physical education teaching experience, one of whom specializes in older adult strength training. The third personal trainer is a competitive woman's powerlifter and bodybuilder with over twenty years of experience coaching physical fitness.

The Likert scale used with this project evaluation is a five-point rating system ranging from strongly agree to strongly disagree (see Appendix B.)

In addition, this manuscript was reviewed by 20 San Francisco Bay area residents ranging in age from 22 to 72. These subjects rated the manuscript using the same scale as the experts, thus allowing for a "lay-person" comparative evaluation.

Each point in the Likert scale indicates a favorable or an unfavorable response. The scale points range from one to five, with one being least favorable and five being the most favorable. All points are assumed to be of equal value, and the responses are weighted to indicate the degree of agreement. Most of the questions on the evaluation form are stated in the positive, however, to counter-balance, some of the questions are stated in the negative. For these questions the scale is reversed so that "strongly disagree" equals 5, a positive response, thus maintaining consistency. The average score per question with the total score of the evaluation is used as an indicator of the quality of the book. By summing the scores and dividing the total number by the number of statements/questions on the

evaluation form a mean score for the book was determined. "Uncertain" was also included in the Likert scale answer set to give the evaluator the option of not evaluating a statement.

Ten subjects over 65 years of age were also selected from the San Francisco Bay area to complete a pre- and post-test. The vast population of the San Francisco Bay area provided a cross-section of older adults with regard to ethnic and economic differences. The test was created from the book chapters and consisted of approximately ten true-false and multiple choice questions (see Appendix C.) The participants' scores on the test were expected to improve after reading the book. Each correct answer on the pre- and post-test was assigned one point. Each incorrect answer received a zero point value. The pre-test scores were not shared with the subjects. The post-test was reordered to avoid the problem of sequencing. The questions and the answers remained the same for both the pre- and post-test. Because this design provided a comparison between performances by the same group of participants, a dependent t test was applied to determine if the book significantly improved knowledge regarding older adult strength training.

The results from this pre- and post-test and the t test appear in Chapter IV of this project.

Summary

Chapter three describes the procedures that were necessary to complete this project. The manuscript has evaluation instruments including a pre-test and post-test and a five-point Likert-type rating system consisting of ten questions. The manuscript will be evaluated by a panel of experts, and a sample group from the general population. A group of older adults (over 65 years of age) will complete a pre- and post-test. The data collected from the evaluation and the pre- and post-test will be used to describe the quality of the book.

CHAPTER IV

Results

The purpose of this project was to create and evaluate a strength training book for older adults, entitled "Rest Not Rust Not," that uses the exerciser's body weight as resistance. In this chapter quantitative and qualitative findings from an evaluation of the project are presented. The descriptive data from the results of the questionnaires and pre- and post-tests are also presented.

Results of the Questionnaires

The evaluation of "Rest Not Rust Not" resulted in positive questionnaire responses from the expert ($M = 4.06$, $SD = 0.8$) and general group ($M = 4.51$, $SD = 0.4$) on the 5 point Likert Rating scale (Tables 1 & 2).

The expert group consisted of eight reviewers, four men and four women, between the ages of thirty-three and sixty-five. Three of the expert reviewers were personal trainers, one specialized in older adult strength training. Two reviewers were physicians who have older adult patients and are concerned with geriatric physical fitness. One reviewer was a sports podiatrist, another was a geriatric sports author and

magazine editor; and, one reviewer was a World Gym owner (Table 1).

With an anticipated 50%-60% response rate, thirty-eight subjects (nineteen men and nineteen women) were chosen from the San Francisco Bay area. After sixteen weeks of data collection the desired number of twenty evaluations had been received.

The general group consisted of twenty reviewers, eleven men and nine women, between the ages of twenty-two and seventy-two. Their occupations varied widely, offering a cross-section of respondents, such as a firefighter, a sales executive, an attorney, a waitress, and a pilot. Thirteen of the twenty subjects indicated that they were high-level exercisers (greater than 1 hour of exercise a week), while just five subjects rated themselves as moderate-level exercisers (1 hour of exercise a week). Only two subjects admitted that they were low-level exercisers (less than 1 hour of exercise a week).

Results of the Pre- and Post-tests

The pre- and post-test results for the older group indicated an increase in the knowledge of the effects of freehand strength training on older adult health and fitness.

The older group consisted of ten subjects, five men and five women, between the ages of 65 and 85 years. All of the subjects were residents of the San Francisco Bay area for at least twenty years, and all but two subjects were retired. The mean pre-test score was 56% correct (SD = 22.71). The mean post-test score was 85% correct (SD = 15.81) (Table 3). The standard errors for the pre-test and the post-test score were 0.718 and 0.500, respectively. The overall standard error for both scores was 0.690. The results from the dependent t test comparing the pre- and post-test scores within the same group yielded $t(9, n=10) = 4.20, p=.002$.

Table 1

Questionnaire Responses From the Expert Group (n=8)

SA--Strongly Agree

D--Disagree

A--Agree

SD--Strongly Disagree

U--Uncertain

N--No Opinion

Question	SA	A	U	D	SD	N
1. This manuscript was informative.	6	2	0	0	0	0
2. The writing style and format of this was clear and understandable.	3	5	0	0	0	0
3. This manuscript provided me with novel exercise information.	3	1	1	2	0	1
4. This manuscript contained suf- ficient "background" information.	5	2	0	1	0	0
5. The introductory section was under- standable.	6	2	0	0	0	0
6. This manuscript provided me with good ideas for my own fitness pursuits.	1	3	0	3	0	1
7. The length of this manuscript was ap- propriate to the material presented.	4	3	0	0	1	0
8. I would recommend this reading mate- rial to friends of mine.	4	2	1	1	0	0
9. This manuscript held my interest.	2	5	0	1	0	0

Table 2

Questionnaire Responses From the General Group (n=20)

SA--Strongly Agree

D--Disagree

A--Agree

SD--Strongly Disagree

U--Uncertain

N--No Opinion

=====						
Question	SA	A	U	D	SD	N
=====						
1. This manuscript was informative.	10	10	0	0	0	0
2. The writing style and format of this was clear and understandable.	14	6	0	0	0	0
3. This manuscript provided me with novel exercise information.	8	10	1	1	0	0
4. This manuscript contained suf- ficient "background" information.	12	8	0	0	0	0
5. The introductory section was under- standable.	14	6	0	0	0	0
6. This manuscript provided me with good ideas for my own fitness pursuits.	9	7	1	2	0	1
7. The length of this manuscript was ap- propriate to the material presented.	9	10	1	0	0	0
8. I would recommend this reading mate- rial to friends of mine.	11	8	1	0	0	0
9. This manuscript held my interest.	10	10	0	0	0	0

Table 3

Subjects' Scores on the Pre- and Post-Test

<u>Subject</u>	<u>Pre-Test</u>	<u>Post-Test</u>	<u>% Change</u>
1	80%	100%	20
2	50%	90%	40
3	80%	100%	20
4	40%	60%	20
5	50%	80%	30
6	20%	80%	60
7	70%	60%	-10
8	40%	80%	40
9	90%	100%	10
10	40%	100%	60
	<u>M</u> = 56%	<u>M</u> = 85%	<u>M</u> = 29%
	<u>SD</u> = 2.271	<u>SD</u> = 1.581	<u>SD</u> = 0.69

CHAPTER V

Summary, Discussion, Conclusions and Recommendations

This chapter contains a summary of the project, discussion, conclusions, and recommendations from the statistical information compiled from evaluating this project. The data from the expert and general population questionnaires and the older adult pre- and post-test are interpreted.

Summary of the Project

The purpose of this project was to create and evaluate a book outlining an exercise program for older adults (65 years and above) that uses the exerciser's body weight as resistance in a strength training program.

The hypotheses established for this project were: (a) the book will be deemed effective based upon the responses of an expert group and a general population group to a Likert-type rating scale, and (b) there will be an appreciable educational benefit for older adults demonstrated by the difference between the pre- and post-test scores on an educational test administered to the older subjects.

This book contains two introductory chapters: one explaining the benefits of regular exercise for

older adults and the other offering guidance in choosing a training program. The beginning section also includes a discussion of geriatric strength training, current research in elderly strength training, and the physiological characteristics specific to older adults involved in resistance training.

The next section of the book presents four chapters: a warm-up and cool-down chapter, a chapter of beginning level freehand strength training exercises and progressing through intermediate and advanced levels. Following the advanced exercise chapter there are some closing comments regarding motivation, diet, body composition, and proper sleep.

Summary of the Evaluation

To evaluate this project a questionnaire with a Likert-type rating system was designed. A panel of eight experts was selected to review the manuscript (expert group). In addition, this project was reviewed by 20 San Francisco Bay area residents ranging in age from 22 to 72 (general population group) using the same scale.

Ten subjects over 65 years of age were also selected from the San Francisco Bay area to complete a pre-test, read the manuscript, and complete the

post-test. The test was created from the book chapters and consists of ten true false and multiple choice questions. The questions and the answers remain the same for both the pre- and post-test. Because this design provides a comparison between performances by the same group of participants, a dependent t test was applied to determine if the book significantly improved knowledge regarding older adult strength training.

Discussion

The questionnaires used a five point Likert scale ranging from strongly agree to strongly disagree. There was also a section for written responses under each of the nine questions and a final question for strictly qualitative analysis entitled "comments."

Both the experts and the general population sample completed the same questionnaire. The mean overall manuscript rating for the experts was 4.06 with a standard deviation of 0.8 (where 5.0 is the most favorable response). The mean rating for the general population using the same parameters was 4.51 with a standard deviation of 0.4.

The pre- and post-test results from the older adult sample group demonstrated the educational

quality of the manuscript "Rest Not Rust Not." The mean value for the older adults on the pre-test was 5.600 out of ten (SD = 2.27). The mean value on the post-test for the same group was 8.500 (SD = 1.58). Thus, after having read the manuscript the older adults improved their test score an average of 29%.

Conclusions

The experts' mean responses to questions one through nine ranged from 2.875 (SD = 1.642) to 4.750 (SD = 0.463). The two lowest rated "expert" responses were to questions number six (2.875, SD = 1.642) and three (3.250, SD = 1.832). Question number six stated: "This manuscript provided me with good ideas for my own fitness pursuits." And question number three stated: "This manuscript provided me with novel exercise information." Since health and fitness experts have a substantial amount of background exercise information and, likewise, their own ideas for their own fitness pursuits, this rating is somewhat expected.

The general population's mean responses to questions one through nine ranged from 4.00 (SD = 1.338) to 4.750 (SD = 0.444). Questions six (M = 4.000, SD = 1.338) and three (M = 4.250,

$SD = 0.786$) received significantly higher ratings from the general population. Interestingly, questions six and three also received the lowest ratings among the general population. This can be explained by an underestimation of the sample's exercise background. The general population sample was drawn from the San Francisco Bay region which is an area that emphasizes the merits of health and fitness.

The two most highly rated questions from both the experts and the general population were number one and number five, $\bar{M} = 4.750$, $SD = 0.463$ and $\bar{M} = 4.750$, $SD = 0.444$, respectively. Question one stated, "This manuscript was informative." And question five stated, "The introductory section was understandable." From this data, it is apparent that the book contained useful information; and, the scientific material presented in the introductory section was not beyond the comprehension of lay-people.

Recommendations

The corresponding highest and lowest questionnaire ratings for both the "expert" sample and the "general population" sample leads to several general recommendations regarding the manuscript, "Rest Not Rust Not." The closeness of the highest ratings among

the two sample groups indicates unanimous approval of the manuscript's introductory section and the quality of the overall information. The relatively low ratings given by both sample groups to the questions concerning the novelty of the exercises presented in the manuscript and their practical application indicate the need for a possible restructuring of the three exercise sections.

From question ten on the evaluation form, the written comment section, several ideas for exercise reorganization were proposed. Among the expert comments, recommendations included: dividing the book into two separate texts - one devoted entirely to exercise instruction and the other a scientific reference manual. They also recommend limiting the number of exercises for each body part to one in the beginning and intermediate chapters. Both of these recommendations were made with the intention of making the book less intimidating and more accessible to novice exercisers.

The general populations' written recommendations were less analytical. The responses consisted mostly of comments such as "good work," "I bet a lot of time went into this project," etc. However, several

reviewers did complain that the manuscript lacked pictures of the exercises (photos were absent in the manuscript evaluated). Also, two of the general population reviewers recommended lessening the number of exercises for each body part in the beginning and intermediate chapters.

After reviewing the comments and recommendations from the qualitative analysis portion of the evaluation, question number ten, three main changes are necessary to improve the usefulness of this text to the public. First, instead of separating the book into two texts, the scientific portion which discusses things like muscular hypertrophy will be included in a referenced glossary following the exercise chapters. Second, clear and simple illustrations will accompany each exercise and stretching maneuver. Third, in the beginning and intermediate exercise chapters there will be one exercise for each body part. For example, a typical exercise program might have modified push ups for the upper body, crunches for the abdomen, and wall sits for the upper leg.

The evaluation responses regarding the lack of novelty of the exercises in this book do not detract from the book's quality. The exercises which appear in this book have likely been around since the

beginning of physical education. However, the important concept here is not the discovery of something new, but the proper application of effective training techniques.

Specific recommendations concerning the evaluation and test administration portion of this project include: using less technical language on the evaluation and pre- and post-test forms, emphasizing that evaluators and test subjects will not be held accountable for their responses, and using greater perseverance recovering evaluation forms promptly. Actually, these three recommendations are related.

Several of the evaluators (from the general population group) and three of the ten older adult test-takers indicated that unfamiliar words such as "novel" and "cardiorespiratory" and "hypertension" confused them and created anxiety. Several subjects from all three groups, the experts, the general population, and the older adults, reported that they were anxious while completing their respective forms. They complained that they felt pressure, as though they would be judged by their responses. And finally, greater perseverance in assuring evaluation form completion and submission would have expedited data

recovery, and increased the total number of responses. In addition, it might have allayed some subjects' fears regarding their evaluation responses. Improvement on future education tests and evaluation forms should include lowering test subject anxiety. Changes such as the use of everyday language and improved written instructions could aid future researchers and their subjects.

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APPENDIX A

REST NOT

Strength training

calisthenics for older
adults

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USE IT OR LOSE IT

Who Knows Best?

I remember hearing my grandmother telling my mom to "grow old gracefully." She was upset because her daughter was still swimming over a mile a day after the age of fifty. My mom just smiled and said, "I feel great mother, you should take up some sort of exercise as well." My grandmother was genuinely concerned that my mom was overdoing it. According to the way she had been raised, most adults (and women in particular) were risking disaster if they didn't drastically reduce their physical activity as they aged. Well, that conversation occurred almost ten years ago and since then my mom has doubled her swimming distance, and added calisthenics and weight training to her daily physical fitness schedule - and she just turned sixty-four.

I use this example to illustrate how different opinions can be regarding exercise and older adulthood - even among members of the same family. A few weeks ago I was talking with a friend of mine and he commented that, at his age, it's time to cut back on exercising, and spend more time relaxing. After all, he's made it all the way to forty-three! I contrast this with the attitude of another friend of mine who lifts weights for an hour and a half each day, runs two businesses, and has a busy social

schedule - and he just turned sixty-seven! This person's attitude reminds me of the adage: "rest not, rust not."

Science Says ...

In support of that notion, current research indicates that it is best to stay active with age to maintain a higher quality of life. The most drastic physical changes seen in older adulthood include declines in ability to do work and maximum heart rate, muscle strength and size, bone mineral density, and the function of many organ systems.

Work capacity refers to the efficiency with which oxygenated blood is delivered to working muscle. Maximum cardiac output is a measure of the maximum volume of blood ejected from the heart. Both of these components of physical fitness are enhanced through regular physical training especially aerobic activities such as swimming, hiking, and jogging. The term aerobic indicates a situation where oxygen combines with an energy source (such as fat molecules) during muscular activity. Conversely, anaerobic refers to a situation where muscle tissue elements (such as phosphagen and glucose molecules) produce energy without oxygen during muscular movement. Aerobic exercises increase heart muscle strength and expandability, improve blood vessel elasticity, and increase muscle cell oxygen uptake efficiency at any age. This reminds me of an observation made by a friend of mine who used to drive a county transit bus. Many of his passengers were retired

and well over 65 years of age. Frequently he'd get out of the bus and assist these older passengers when boarding. Although there were only three steps from the street to the seats, many of the elderly didn't have sufficient circulatory fitness to keep from getting dizzy. However, some of his older passengers not only boarded easily, but actually ran for the bus. These passengers, without exception, had maintained active lifestyles with regular participation in activities such as dancing, hiking, and swimming.

Old Muscles Can

Human skeletal muscle will respond to resistance training, such as weight lifting or calisthenics, by increasing in strength and size, whether the muscle is twenty-six or ninety-six. The body doesn't intellectualize, it just adapts to the environment created for it, and if that environment calls for overcoming resistance, then the muscles will respond and grow. Of all the physical declines associated with aging, muscle strength loss is the most limiting in terms of daily activities such as rising out of a chair, opening a jar, or lifting household objects. However, with appropriate resistance training even nursing home patients over 80 years of age can increase muscle size and strength. This is evidenced by cases like Austrian power lifter Helen Zechmeister who at 81 could lift 245 pounds from the floor to her waist and

once won a 35 years-and-older weight lifting contest for men!

Stronger Muscles = Healthier Body

An important health concern for older adults, especially post-menopausal women is a loss in bone mineral density. However, bone mineral density has been found to increase or decrease based upon the amount of stress placed upon the bone. For example, bone tissue, the main function of which is to give muscle support, becomes denser and stronger as it adapts to weight bearing resistance exercises. Recent studies conducted on women over 65 years of age have concluded that bone mineral loss may be reversed through weight-bearing physical activity and improved nutrition. Again, this is an example of the body instinctively adapting to its environment.

A controllable cause of organ system dysfunction, especially in the physically unfit and the elderly, is abdominal muscle atrophy producing visceral prolapse. Visceral prolapse is a downward and forward slippage of the internal organs as the abdominal muscles yield to gravity. Digestion of food and elimination of waste are impaired and an additional strain is placed on the heart, kidneys, and liver. By strengthening the abdominal muscles, the lower viscera are repositioned and the organ systems' functioning is improved.

Body and Mind

As these examples indicate, the physical benefits of exercise for older adults are significant; however, there's also evidence that exercise has a positive social and psychological effect too. According to recent studies, physical exercise improves emotional well-being by overcoming depression, encourages social interaction by improving self-image, and provides a natural way to sustain mental alertness in the aging individual by increasing oxygen to the brain. In a study specifically examining the increased psychosocial benefits of physical activity for women, researchers noted that older women who participate in regular physical activity programs not only experience physical benefits, but also an increase in self-esteem and improved stress management.

Another way to interpret the effects of exercise on older adult psychology is by examining the exercise-aging cycle. According to this model, with increasing age, physical activity declines which leads to increased body fat, increased anxiety, increased stress, decreased muscle mass, low self-esteem, and depression. Reversing this cycle is possible with a program of regular exercise. Studies have shown that physical activities such as weight lifting and running effectively combat anxiety, low self-esteem, and depression. However, one mistake many new exercisers make is starting out too vigorously! Overdoing

it in the beginning can lead to chronic fatigue, mental depression, and eventually cessation of physical activity. The key to sustaining and benefitting from physical training is to start out gradually and to pace yourself, building slowly and steadily. The body and mind need time to adjust to new activity levels. That is why the programs contained in this book are designed to be gradual and progressive. Stay with the pace set in this book and you will make progress.

SHAPING UP YOUR BODY

Choosing An Exercise Program

Physical activity is at least as necessary for good health as proper diet and adequate sleep. The question many prospective exercisers ask themselves is: "What type of activity is right for me?" The answer is to establish a set of physical fitness goals, and through inquiry, research, and application construct a training program which is enjoyable and will enable you to attain your goals. For example, suppose you want to tone up your legs and increase your stamina. But, a running program does not appeal to you. In this case, exercising in a gym on a treadmill or stair-stepper may be the answer.

According to the American College of Sports Medicine's guidelines for physical fitness, a well-rounded conditioning program should include activities that promote cardio-respiratory fitness, muscle and joint flexibility, and muscular strength and endurance. Ideal activities for developing and maintaining cardiorespiratory fitness are performed at least three times a week, use large muscles and can be maintained for prolonged periods. Flexibility exercises consisting of slow, gradual movements and static stretching should be included with other physical activity as a warm-up and cool down for the body's major joint systems. Muscular strength, which refers to how heavy an

object a person can lift, and muscular endurance, which refers to how long or how frequently in succession a person can lift an object, are maintained or enhanced by appropriate high-tension weight lifting or calisthenics performed at least three times a week.

Taking into account these components of physical fitness, the purpose of this book is to outline an exercise program for older adults (65 years and older) that uses the exerciser's body weight as resistance in a strength training program. This book will present to the reader a series of progressive resistance muscle building exercises aimed at enhancing and maintaining strength in the legs, back, chest, trunk, arms, and shoulders. Since muscle building is a major goal of this book it is advisable to have some background knowledge on how muscles work and grow.

How Muscles Work:

There are over 600 muscles in the human body and they are used in every facet of our lives. These muscles are divided into three categories: cardiac muscle (heart muscle), smooth muscle, and skeletal muscle. The first two groups, cardiac and smooth muscle, function automatically when stimulated by the lower brain and are used in such life-sustaining activities as blood circulation, food digestion, and blood pressure regulation. The last group, skeletal muscle, or voluntary muscle, functions when stimulated by the higher brain centers and is used in such

activities as walking, running, lifting, and throwing. Skeletal muscles are used in gross body movement and are the ones you'll be most concerned with in this book.

A large percentage of our body is skeletal muscle. This skeletal muscle is made up of very thin fibers (0.0004 to 0.004 inch in diameter) up to 12 inches in length. Each fiber is covered by a thin membrane and bound together with other fibers to form bundles. Each bundle is bound together with other bundles to make up one large muscle group such as the shoulder and thigh muscles.

Skeletal muscles, as their name suggests, are used to move the body's bones. For example, the biceps brachii (front upper arm muscle) flexes and rotates the forearm bones, the radius and ulna, at the elbow joint. This movement and all other skeletal muscle movement is achieved by the transmission of nerve impulses from the brain to the muscle fibers. When the neural impulse reaches the muscle fiber, filaments within each fiber become attracted to one another and the fibers slide toward the middle of the muscle. This shortening is known as a contraction and it happens every time a muscle moves. Another way of looking at this activity is to consider muscle filaments at rest as "magnetically" repelled from one another and muscle fibers at work as "magnetically" attracted to one another. The interplay within the muscles between fiber attraction and repulsion gives us our ability to move.

How Muscles Grow:

The main factors which determine a person's muscular strength are genetic inheritance and muscle size. Genetic inheritance pertains to uncontrollable factors such as limb length, muscle-bone attachment sites, and muscle fiber composition. Fiber composition refers to the two basic fiber types found in human skeletal muscle. Red fibers, also known as slow twitch, are vital for sustained aerobic, low resistance exercise. White fibers, also called fast twitch, are most effective in short duration, anaerobic, high resistance exercise. Whether a person is good at endurance or power activities is strongly associated with their genetically determined percentage of red and white fibers.

Muscle size is related to the number and size of myofibrils contained within each muscle fiber. The more myofibrils the larger the muscle fibers and the larger the fibers the bigger and stronger the muscles. Current science indicates that the number of muscle fibers does not increase; it is the number of filaments within the fibers that increase from strength training. However, some animals do show signs of increased muscle fiber number (hyperplasia) - perhaps in the future we'll know more about these changes in humans.

In any event, muscle size is a partially controllable component of human strength acquisition and therefore the

primary concern of any strength enhancement program. Muscle growth occurs in direct response to the amount of resistance which a muscle must overcome when performing a movement. Myofibrils within each muscle fiber increase in number by synthesizing available protein (hypertrophy). Since myofibrils are the contracting portion of a muscle, the more myofibrils a person has the greater the size and strength of a muscle.

For example, a beginning exerciser may not be able to perform a chin-up on a horizontal bar. However, with proper strength training this same person will soon succeed. What changed? Well, in a manner of speaking, this person's muscles have become "familiar" with their body weight. Through filament growth (hypertrophy) of the shoulder, back, chest, and arm muscles our hypothetical exerciser has developed sufficient strength to overcome the force of body mass times gravity and "chin the bar."

Older Adult Strength Training:

Modern medicine and dietary improvements have increased the lifespan of American citizens; but, is a longer life a better life? Or, are we condemning millions of people to years of life while suffering from arthritis, osteoporosis, heart disease and muscular atrophy. Many of the physical factors which limit the ability of the elderly to function independently within our society, such as

balance and locomotion, are due to a loss in muscle strength.

Surveys throughout the United States have shown that after the age of 74 years, 28% of men and 66% of women can't lift objects weighing more than 10 pounds - roughly the weight of a sack of flour. However, positive adaptations to resistance training in adults over 65 years of age have been demonstrated. A recent study reported that older adults can respond to weight training or calisthenics with increases in whole muscle fiber size, as well as increases in muscle strength. This evidence raises the encouraging prospect that the rate of decline in strength in old age can be reduced or even reversed with appropriate strength building programs.

Even more impressive than this study is one which involved bedridden nursing home patients. These researchers found that high resistance strength training led to a substantial increase in muscle strength, size, and functional mobility among frail residents of a nursing home up to 96 years of age!!

Even with positive study results such as these, older adult strength training is a very new concept and we have only hit the "tip of the iceberg" when it comes to the associated benefits. For instance, one negative effect of human aging is a drop in metabolism and an increase in fat storage - assuming caloric consumption remains the same.

Metabolism can be thought of as the body's energy thermostat; the more oxygen-consuming, energy-burning tissue (i.e., muscle) a person has, the higher their metabolic rate. Therefore, added muscle mass makes stronger and leaner bodies, which lowers the risk of heart disease, and improves one's appearance and self-esteem.

Strength training has not always received the publicity other physical activities have. The fitness craze which is currently sweeping the United States has primarily emphasized aerobic training. While aerobics are necessary to a balanced fitness program, equal attention needs to be focused upon strength training, especially for the elderly. Within the last two years the American College of Sports Medicine developed guidelines for strength training for people 65 years of age and older. They advise weight lifting with machines and light free weights. If weight lifting equipment is not available, ACSM recommends calisthenics. The calisthenic routine should consist of 8 to 10 exercises covering the back, chest, shoulder, trunk, and leg muscles. These exercises should be performed no more than three alternate days a week to build strength, and no less than two non-consecutive days a week to maintain strength.

WARMING UP

Background Motives

The strength building exercises which appear in this book are called freehand exercises because they require minimal apparatus. Resistance in these routines is supplied by the exerciser's body weight. An exercising muscle can't distinguish whether it's lifting a barbell loaded with iron plates or body weight. In either case, provided the muscle contracts with sufficient force, muscle size and strength will increase.

The idea of using body weight as resistance in a strength training program has been a popular concept among physical educators since at least the 18th century. During the time known as the Age of Enlightenment the human body became the object of intense scientific interest. Philosophers and physicians focused their attention upon questions concerning anatomy, physiology, health and human motion. Scholars such as Jean Jacques Rousseau urged men of the 18th century to cultivate their bodies as well as their minds with regular, vigorous exercise.

What Rousseau endorsed in text, others such as Johann Friedrich GutsMuths, Per Henrik Ling, and Friedrich Ludwig Jahn put into practice in their physical education classes. Jahn of Germany is of particular interest to this book. Unlike GutsMuths and Ling, whose teachings included

exercise routines aimed at developing grace, flexibility, and balance, Jahn devoted his attention to exercises that built strength. Jahn was a highly patriotic nationalist whose ultimate goal was to build extremely fit soldiers capable of crushing any other military force. Jahn's trainees were called Turners (German for gymnast) and they exercised on horizontal and parallel bars, climbing poles, ladders, and ropes. The Turners performed and made famous many of today's most familiar exercises such as push-ups, chin-ups, dips, and foot races.

Jahn and his followers were eventually viewed as a political threat and the Turners were disbanded by the German government. However, the teachings of Jahn were readily assimilated into the growing Physical Education movement of the 19th and 20th centuries. This influence can be seen in the American Intercollegiate Strength tests of the 1930's which included chinning on the horizontal bar and push-ups as measures of upper body muscular strength. Yet, despite the substantial history of freehand exercises, the formalization of a strength training program based upon body weight resistance training has received limited coverage in physical education literature.

Just like the routines Jahn and his followers practiced, the workouts in this book are strenuous and demanding. Any person performing these exercises should make sure they are physically up to the challenge.

Personal Fitness Assessment:

Before beginning any exercise program it's advisable to get a physical exam. This is especially critical for adults who have not exercised regularly for a long time. A complete physical exam should include a stress test which determines how well the heart responds under increasing amounts of exercise. For the stress test a patient either walks on a treadmill or pedals a stationary bicycle while heart electrical activity is recorded by an electrocardiogram. From this test the physician can determine if there are heart abnormalities requiring treatment prior to initiating the exercise program.

It's also advisable to specifically inform the examining physician as to the type of exercise you'll be performing. For example, I'd recommend bringing this exercise book along to the physical exam so that the doctor may review it.

Eating And Exercise

Once you've been medically cleared to start exercising there are some simple rules which will enhance your exercise experience. Always try to finish eating at least two hours before working out. This is important because it allows for proper digestion and avoids the circulatory conflict of blood used for digestion versus blood used for the muscles directly involved in the exercise. Exercising without allowing for proper digestion can cause nausea,

muscle cramping, and excessive fatigue. Also, avoid eating right after you exercise. Wait about an hour and give your body a chance to cool down and return to a resting state, relaxed breathing, cessation of sweating, and a pulse rate of between 60 and 100 beats a minute.

Exercise Clothing

It's best to wear comfortable clothing when exercising. Lycra, acrylic, nylon and other synthetics are good, but I prefer a natural fiber like cotton. Cotton absorbs perspiration and is gentle on the skin. It also stretches and gives with the contour of the body. Also, I recommend wearing as little as necessary to avoid movement constriction. For footwear I advise athletic shoes with good arch support.

Air And Water

Another important consideration is proper ventilation. Your body needs oxygen-rich fresh air to maintain its energy level. Always exercise in a well-ventilated wide-open area like a garage, back porch, or spacious room. Even in the winter perform your workouts in fresh air, adjusting to the crispness will enhance your circulatory system. Be cautious when exercising in a hot, stuffy environment; these conditions will cause you to grow languid and may ultimately deprive you of an effective exercise session. Also, always keep plenty of cool, fresh

water available to sip before, during, and after your workout.

Exercise Breathing

Exercise breathing rules are fairly simple. It's best to breathe out when you are opposing resistance and breathe in when you are relaxing. For example, when performing a push-up, breathe in as you lower your body and breathe out as you raise your body.

Why Warm Up and Cool Down?

The most important rule of exercise involves proper warm-up and cool-down techniques. Prior to beginning your workout always prepare your body for the rigors of exercise. Following your workout it's equally important to actively recover from a bout of exercise. Warm-up and cool-down techniques are similar in that they both involve stretching and light aerobics, but their goals are different.

A warm up for the human body serves a similar purpose as a warm up for an automobile. When a car starts up most of the oil is in the pan. Idling the engine up gradually distributes the oil over the working parts. When the human body is at rest, most blood is in the abdomen aiding in food digestion or other visceral activities. Low resistance exercise prior to vigorous exercise increases blood flow to the limbs and other peripheral body parts. Warming up these areas brings necessary nutrients and oxygen to the

skeletal muscle and helps improve physical performance and reduce the risk of injury.

Gradually idling an automobile engine down following heavy use cools the metal, eliminates viscosity build up, and helps prevent part seizures. A warm down for the human body following vigorous exercise - also known as physically active recovery - cools the body down by maintaining evaporative heat loss due to perspiration, helps prevent peripheral blood pooling, and facilitates circulatory reabsorption of post-exercise muscle cell by-products, such as lactic acid.

Warm Up Exercises

Warming-up for exercise is a great way to prepare body and mind for the coming challenge. As you're limbering your arms, back, and legs think about the exercises you'll be doing for these specific body areas. By visualizing your muscles performing the exercises, you'll be preparing yourself mentally for the concentration necessary to properly get the most out of your workout.

Arm Overs

Begin your warm-up by standing in the center of a well-ventilated area. Take five to ten deep, slow breaths holding your head up high, with your shoulders back, stomach in, and rib cage held high. Next, lift both arms over your head and rotate them slowly in a full circular motion - similar to the arm motion used in swimming the

back stroke. Perform about ten to fifteen arm circles and then relax by placing your hands on your hips or dangling them at your side.

Aerobics

To stimulate skeletal muscle circulation I advise performing at least five minutes of aerobic exercise prior to stretching. I recommend jumping jacks or running in place with arms elevated above your head. An alternative to these warm-up exercises is step ups. (Step-ups are effective and somewhat less stressful than jumping jacks or running in place.) Just find an ordinary household stair

step - approximately eight inches high. With an alternating one-two stepping cadence, step up and down on the stair while raising your arms up over your head. Arm raising while stepping or running in place is necessary to stimulate circulation to the arms.

Initially, it will be difficult to maintain five minutes of continuous exercise. Don't worry; that's normal. It will take your body a few weeks to get used to an increased level of activity. The key here is to maintain an elevated heart rate for at least five minutes (+100 bts/min).

Bent Over Arm Raises

Following the aerobics, stand and clasp your hands together behind your back and rest them on your buttocks. Then, bend forward and raise both arms with hands still clasped. Hold your upper body parallel to the floor. Maintain this position while attempting to raise your extended arms and clasped hands until they are perpendicular to the floor. This position should be held for approximately thirty seconds. This movement is great for stretching many muscles in the upper body - the chest, back, shoulders, and arms; however, this position may bother someone with lower back problems. In this case, skip the forward bending and perform the exercise in an upright position.

"T"-circles

Next, while standing erect with both arms at your sides, lift them straight out and hold to form a "T." Now, with your arms fully extended and your palms open begin rotating your arms and your hands in a tight (8-10 inch) clockwise circle. Maintain this position and motion for a count of thirty and then relax. Next, reform the "T." However, this time rotate your arms in a counterclockwise motion for a count of thirty. This exercise is extremely effective for warming up the shoulder girdle and the upper arms.

Seated Bend Overs

The next area to be stretched is the lower back and legs. Place a thick towel or exercise mat on the floor and sit upright in the middle of it. Extending your legs straight in front of you on the floor bend forward at the waist and grasp both ankles. While keeping your legs flat on the floor slowly try to touch your forehead to your shins. Move gradually and never bounce. Hold yourself in the furthest downward position you can manage for a count of thirty and then relax and return to upright slowly.

Lotus

The next exercise stretches the inner thigh and groin area. Again, sitting in an upright position, grasp both your feet with your hands (soles together) and draw your heels toward your groin slowly. Then, push both knees towards the floor and hold in the lowest position possible for a count of thirty, then relax.

Hamstring Stretch

From your seated upright posture on the floor, lie back in a supine position and extend both legs. You should be lying perfectly flat on your back with your hands at your sides. Slowly, lift and flex your left leg and grasp it with both hands right behind the knee on the back of the thigh. While keeping your back, head, and right leg flat on the floor slowly pull your left knee toward your nose. Once you have drawn your knee up as far as possible, hold this position for a count of thirty and relax. Repeat this

same sequence on the right side, then relax. This exercise limbers up the lower back, the buttocks, and the back of the thigh.

Elevated Striders

Next, position a chair up against a wall with the seat pointing towards you. Standing in front of the chair lift your left foot up on the seat. Bracing your hands against the wall, slide your right foot back and flex your left knee as far as is practicable. Keep your head up and your back straight and hold this position for a count of thirty. Repeat this same sequence on the right side, then relax.

This exercise primarily limbers up the front of the thigh, and, to a lesser extent, the back of the thigh and the calf.

Calf Stretches

Now, the only area left to be prepared for exercise is the calf or lower leg. Stand facing a wall about two feet away. Your feet should be shoulder width apart and pointing straight ahead. In this position, lean forward and place your hands on the wall. In the same motion slowly slide your left foot straight back behind you approximately one foot. Keeping both feet flat on the floor with heels

down slowly flex your left knee and slightly flex your right knee. It's critical to keep both feet flat, heels down, especially the left one. By flexing the left knee you increase the pull on the Achilles tendon and further stretch the left calf muscle. Hold this position with the greatest stretch possible for a count of thirty and then relax. Repeat this sequence on the right leg and relax.

Dealing With Muscle Soreness

Before beginning the muscle building sections of this book, we need to discuss muscle soreness. Whereas muscle soreness is a normal part of strength training, chronic

burning pain may indicate a strained muscle, ligament, or tendon. Soreness that persists for several days in or near a joint usually suggests an injury. In any case, if you develop an area of persistent soreness, discontinue any activities which cause pain and consult your doctor. Also, for lower-back safety rolling up gradually out of "bent-over" exercise and stretching positions is much more gentle than straightening up immediately.

STARTING UP

Beginning Level Strength Exercises

Now that you have sufficiently warmed-up and prepared for your workout it's time to get acquainted with the beginning level exercises for freehand strength training. This routine should be performed on three non-consecutive days each week. I recommend working out on Monday, Wednesday, and Friday and then recuperating on Tuesday, Thursday, Saturday, and Sunday.

Upper Body Exercises

The first freehand exercise covered is a variation on the push-up. Ordinary push-ups aren't always manageable for a beginning exerciser and that's why you'll start with modified push-ups. Just as with the stretching, I advise putting a thick towel or exercise mat on the floor. Assume a kneeling position in the center of the mat and lean forward so that your palms are flat on the mat, shoulder width apart, fingers pointing straight ahead and chin up. With your back and hips straight slowly lower yourself the rest of the way down until your chin lightly touches the mat. In a slow, controlled motion press yourself back to the upright position with your back and hips straight and only your knees and palms touching the mat. Continue this down and up movement until you can't do any more.

Initially, try to complete 5-10 consecutive repetitions (complete movements) of this exercise.

Continue practicing these modified push-ups until you are capable of performing 20 consecutive repetitions. Once you are able to do this you can advance to the intermediate level exercises. As with standard push-ups, this exercise is excellent for strengthening the shoulder, upper arm, and chest muscles.

The next freehand exercise is the modified chin-up. Like push-ups, standard chin-ups are usually hard for beginning exercisers. To perform both standard chin-ups

and modified chin-ups it is necessary to purchase an adjustable doorway chinning bar. These chinning bars are available at most sporting goods stores for about the same price as a large pizza. The chinning bar will come with brackets that secure to the sides of the door jamb. Attach these brackets at forehead height and the same distance from the top of the door jamb. After mounting the chinning bar securely within the brackets take an underhand grip (palms pointing toward you), with your hands about six inches apart. Next, while firmly grasping the bar, tuck your knees up and slowly lower yourself until your arms are fully extended. During this lowering motion pull against the downward force of your weight and try to suspend your descent for a count of ten. When your arms are fully extended pull with all your might and try to lift yourself back up as far as possible and hold. This may initially be an impossible task - it was for me - but pull as hard as you can. Another variation is to stand grasping the chinning bar as described. Pull yourself off of the floor so that your chin clears the bar. This position decreases the range of motion of the exercise and thus makes it easier. You may also hop slightly to help raise your chin over the bar.

The combination of the controlled lowering, the pull at the bottom, and the pull at the top will eventually give you sufficient strength to complete one chin-up. Once you're capable of performing one chin-up you can move to the intermediate level exercises.

As with standard underhand grip chin-ups modified underhand grip chin-ups strengthen the muscles of the hands, forearms, upper arms, chest, and back.

Lower Body Exercises

You have now completed the upper body portion of your beginning level workout. The next pair of exercises strengthens the hip, thigh, and calf (lower leg) muscles. Wall sits are the first of the lower body exercises you'll perform. Stand with your back flat against a wall, feet flat and shoulder width apart, toes pointed slightly outward and heels approximately one and a half feet from the base of the wall. Next, lower yourself down to a position where your knees are flexed at right angles, thighs about parallel to the floor. It's important to hold yourself upright with your back flat against the wall. Don't place your hands on your thighs to alleviate the stress, keep your hands crossed on your chest, and your heels flat on the ground. Also, don't allow yourself to slide down the wall; keep your knees at right angles and your thighs parallel to the floor. Maintaining proper form focuses the stress of the exercise on the thigh muscles and not on the knee joints. Try to hold this position for as long as possible, then relax by standing. Increase your wall-sit time by increments of five seconds until you're capable of one minute without rest. At this time you'll be ready to move to the intermediate level exercises. Wall-sits strengthen the muscles of the hips and upper leg.

The next lower body exercise is the calf raise, and as the name suggests, it benefits the lower leg or calf muscles. While standing on a non-sliding surface and facing a wall, lean forward and place both hands against the wall about shoulder height and spaced about shoulder width apart. Keeping your body straight with your back flat, knees extended, and head up, slowly lift yourself up on your tip toes. Hold this position for a count of two ("one thousand one, one thousand two"). Then, slowly return to the starting position with your heels flat on the floor. Maintaining your inclined position against the

wall, repeat this movement until you can't do any more. When you can perform twenty-five consecutive calf raises you're ready to move to the intermediate level exercises.

Abdominal Exercises

For the midsection or abdominal muscles you'll be performing two exercises, heel-high crunches for the upper abdominal muscles and bent knee leg raises for the lower abdominal muscles. The only equipment required for these exercises is a sturdy wooden household chair and an exercise mat or thick cotton towel.

To perform heel-high crunches lie down on your back on your exercise mat or towel, and put your legs up on a chair. Cross your hands on your chest and keep your legs and buttocks as rigid as possible; while doing this slowly raise your head and shoulders as far as possible off the mat, attempting to touch your nose to your knees. Lift yourself as high as you can and hold this position for approximately one second in the top position. Then, slowly lower yourself to the starting position and repeat until you can't do any more. Be sure to keep your legs flat on the chair and your buttocks flat on the mat throughout this movement. Don't pause at the bottom or relax the tension on your upper abdominal muscles. When you can perform thirty consecutive heel-high crunches you'll be ready to move on to the intermediate level exercises.

Bent knee leg raises are performed while lying supine on an exercise mat or towel. In this position place your hands under your buttocks, palms down, parallel and pointing towards your feet. Place your chin on your chest and slowly draw your knees together and up toward your chin. Hold this position for one second and slowly return your legs to a fully extended position. Don't allow any part of your legs and feet to touch the floor, keep your chin on your chest at all times and maintain your hand position to support your lower back. From the fully extended position, again, bend your knees and slowly draw your legs back up toward your chin. Repeat this movement until you can't do any more. When you're able to perform thirty consecutive bent knee leg raises you can move to the intermediate level exercises. If you have back problems you may want to modify this exercise by placing a pillow under your head and only extending your legs about 3/4 of the way out.

Cooling Down

For the cool-down portion of your workout you'll repeat the warm-up routine. For example, immediately after you complete your abdominal exercises, run in place, step up, or do jumping jacks for about five minutes. This is called active recovery, following your strength building exercises with aerobics. Active recovery helps prevent muscle soreness by maintaining a sufficient rate of circulation to reabsorb muscle cell by-products of strength training such as lactic acid. Active recovery also allows for a gradual "idling down" of the body's energy burning rate instead of an abrupt stop.

Once you have completed the aerobics portion of the cool-down you can begin stretching. Follow the same sequence of exercises, stretching the upper body, lower back, and legs while breathing in a relaxed and steady manner. You should also take this time to relax your mind. Unlike the warm-up where you thought about your upcoming workout and focused your attention on proper exercise execution, now you should shift your thoughts to other things like an enjoyable, relaxing hike in the hills, or a healthy, well-balanced, post-workout meal.

Progression

Once you've successfully completed the beginning level exercises, you'll be ready to move to the intermediate program. At this time you should be able to do at least twenty modified push-ups, one complete chin-up, one minute of wall sits, twenty-five calf raises, thirty heel high crunches, and thirty bent knee leg raises. Depending upon your initial fitness level it may have taken you three to six months to master the beginning level exercises.

It is likely that by now you'll have noticed an aptitude for some exercises and an inaptitude for others. For example, perhaps you can do more than the requisite number of push-ups, and yet when it comes to chin-ups you still can't make one full repetition. In this case I'd recommend combining workout levels. That is, move up to the next higher level for push-ups and stay where you are with chin-ups.

WORKOUT SUMMARY (Beginning)

ACTIVITY	EXERCISES	*REPETITIONS
<u>Warm Up</u>	- arm overs	15 reps
	- aerobics	5 mins
	- bent over arm raises	30 secs
	- "T" circles	30 secs
	- seated bend over	30 secs
	- lotus	30 secs
	- hamstring stretch	30 secs
	- elevated striders	30 secs
	- calf stretches	30 secs
** (10 min)		
<u>Strength Training</u>		
	- modified push-ups	20 reps
	- modified chin-ups	1 full chin-up
	- wall sits	60 secs
	- calf raises	25 reps
	- heel high crunches	30 reps
	- bent knee leg raises	30 reps
	(repeat the warm-up)	
<u>Cool Down</u>		
** (10 min)		

* these repetitions
refer to the optimal
number

** limit rest between
exercises to $\leq$ 1 min

MOVING UP

Intermediate Strength Exercises:

In this section you'll become familiar with the intermediate level freehand exercises. Like the beginning level exercises, the intermediate routine should be performed on three non-consecutive days, Monday, Wednesday, and Friday, or Tuesday, Thursday, and Saturday. This routine also consists of six exercises, two for the upper body, two for the abdomen, and two for the lower body. The increased difficulty of the intermediate exercises is due to the greater percentage of your body weight which you'll be handling.

Warm Up

As with the beginning level exercises always wear comfortable clothing in a well-ventilated environment and keep an adequate amount of drinking water on hand when working out. Follow the same stretching and warm up routine and remember to focus your attention upon mental and physical preparation for the upcoming exercises.

Upper Body Exercises

The first intermediate level freehand exercise which you'll perform is the standard push-up. There are a variety of hand positions which people use when performing push-ups; I advise placing your hands shoulder width apart on your exercise mat (or towel), palms down, and fingers

pointing straight ahead. In this position you'll be working your shoulder, chest, and arm muscles equally. Some people put their hands wider than shoulder width to train the chest, while others put their hands in close (about six inches apart) palms turned inward to concentrate on their arm and shoulder muscles.

With your hands shoulder width apart, arms and shoulders extended, knees off the ground (or mat), chin up, back straight, and legs and hips extended, slowly lower yourself until your chin lightly touches the mat. Maintaining the proper form, slowly press yourself up until your arms and shoulders are fully extended. Hold this position for one second and then slowly repeat the down and up motion. This exercise differs from the modified, beginning level push-ups in that your knees do not touch the ground at all! Complete as many repetitions (down and up motion cycles) as you can.

Throughout this exercise flatten your hips, hold your back straight, your chin up, and do not allow any part of your body, other than your hands, feet, and chin, to touch the floor. Keep your form as perfect as possible; remember, in exercise, quality is often more important than quantity. It's better for your body to do ten perfect push-ups than one hundred sloppy ones. Once you can complete ten consecutive standard push-ups, you'll be ready to move to the advanced level freehand exercises.

Now that you're capable of one chin-up you should work toward performing several without stopping. Again, grasping your chinning bar with an underhand grip and hands about six inches apart, slowly lower yourself until your arms are fully extended. From this position slowly pull yourself up until your chin clears the bar. Then slowly lower your body back down until your arms are fully extended. To build muscle flexibility as well as strength, be sure to get a good stretch at the bottom, between chinnings. Repeat the chin-ups until you can do no more. Again, form is critical when performing this exercise. Keep your body as straight as possible throughout the movement. Don't arch your hips or jerk your legs up to help your chin clear the bar. When you can perform five consecutive chin-ups you'll be ready to move to the advanced level exercises.

Lower Body Exercises

The intermediate leg routine consists of two new exercises: the freehand lunge, and the one-legged calf raise. The first, the lunge, works the muscles of the hip, buttocks, and thigh. Standing with your feet shoulder width apart, hands on your hips, chin up, back straight, and chest held high, slowly step forward as far as possible with your right leg until your right thigh is almost parallel to the floor. Hold your left leg as straight as possible, not bending the knee any more than is necessary. From this position slowly step back to the starting

position). Next, slowly step forward with the left leg and perform the same sequence of movement on the left side. Continue alternating right and left (lunge right, lunge left) - counting each right-left sequence as one repetition until you've completed a total of fifteen repetitions. When you can perform fifteen lunges consecutively you'll be ready to move to the advanced level exercises.

Unlike the beginning level calf raises where body weight is distributed over both calves, one-legged calf raises place the exerciser's entire body weight on one calf - doubling the workload for the calf muscles. Stand erect

with the balls of your feet firmly on the floor. Keeping your back straight, head up, and legs fully extended, balance yourself by placing your hands against the wall. In this position shift all your weight to the right leg and place your left foot against the rear of your right heel. Don't let your hips rock backward and forward during this exercise. Slowly raise up on the toes of your right foot as high as possible. Hold this position for a count of one and really contract the calf muscle up into a ball, relax and slowly return to the starting position. Perform as many right-legged calf raises as you can aiming for a total of twenty-five. Change position to the left calf and repeat the same sequence. When you're able to perform twenty-five one-legged calf raises with each calf you are ready to move to the advanced level exercises.

Abdominal Exercises

For the intermediate abdominal routine you'll be learning two new exercises: alternating crunches, and static leg raises. Alternating crunches strengthen the upper and side abdominals and static leg raises strengthen the lower abdominals. These exercises are significantly more difficult than the beginning level heel high sit-ups and bent knee leg raises. So don't be surprised if you experience some muscle soreness.

Alternating crunches are a favorite exercise of many highly trained athletes such as boxers, gymnasts, and bodybuilders. But, you can also master this exercise. Lie on your back on top of your mat or towel with your knees bent, feet flat on the floor about twenty inches apart. Put your hands on your chest and, keeping your elbows wide, slowly curl up and reach your left shoulder and elbow toward your right knee by contracting only your abdominal muscles. Keep your lower back pressed flat against the floor and your legs stationary. Repeat this sequence with the right shoulder and elbow. Alternate until you have done ten on each side. When you're able to perform twenty-five on each side you're ready to move to the advanced level exercises.

Static leg raises, like bent knee leg raises, are performed while lying in a supine position on an exercise mat. In this position place your hands under your buttocks, palms down, parallel and pointing towards your feet. Place your chin on your chest and slowly raise your feet about fourteen to eighteen inches off the floor while keeping your legs together and straight. It is critical to the effectiveness of this exercise that you keep your chin on your chest, your lower back pressed flat on the mat, your legs fully extended, and your feet fourteen to eighteen inches off the floor. This is a demanding

exercise, but hang in there! Initially, try to hold this position for ten to twenty seconds and then build up from there. When you are capable of sustaining the static leg raise for one minute without resting, then you're ready to move to the advanced level exercises.

Cool Down

Follow the same cool-down and stretching routine you did with the beginning level exercises. Do some aerobics for about five minutes, then stretch your upper body, lower back, and legs. Remember this is an idling down period,

relax yourself mentally and physically. Again, make sure you have plenty of liquid on hand to quench your thirst, and wait at least an hour before eating anything.

WORKOUT SUMMARY
(Intermediate)

ACTIVITY	EXERCISES	*REPETITIONS
<u>Warm Up</u> ** (10 min)	(repeat from beginning level)	
<u>Strength Training</u> ** (15 min)	<ul style="list-style-type: none"> - push-ups - chin-ups - lunges - one-legged calf raises - alternating crunches - static leg raises 	<ul style="list-style-type: none"> 10 reps 5 reps 15 reps 25 reps 25 reps 1 min
<u>Cool Down</u> ** (10 min)	(repeat from beginning level)	<p>* these repetitions refer to the optimal number</p> <p>** limit rest between exercises to $\leq$ 1 min</p>

STAYING UP

Advanced Level Exercises:

At this point you'll be familiar with the warm-up and stretching routine. Prior to exercising you should automatically tune yourself up mentally and physically with the same stretching and aerobic exercises you learned in the beginning section.

Depending upon your initial fitness level and rate of progress through the beginning and intermediate exercises, it'll likely have taken you between nine and twelve months to reach this point. You should now be comfortable with the intermediate level exercises (practice them until you can consistently achieve the suggested repetitions). When you feel that you need a greater challenge in your workout, move on confidently to the advanced level routine.

Upper Body Exercises

The first advanced level exercise is elevated push-ups. Take three chairs that are strong enough to hold your body weight. Place them in a triangular pattern so that the chairs' distance from one another corresponds to your hand and foot positions during standard push-ups. With your hands and feet securely placed on the chairs' seats position yourself in the upright push-up position. Lower yourself as slowly as possible by flexing your arms and shoulders. Your elbows should be flexed well past ninety

ninety degrees so that your upper arm and forearm are touching. Then, slowly press your body back up so that your arms are locked straight, keeping your legs extended and your back straight. Do not allow any part of your body to touch the floor during this exercise. Press straight down on the chairs with equal force to maintain stability. If you push out to the side or favor one side you may capsize the chairs and end up on the floor. That is why I also recommend placing your exercise mat or folded towel beneath you while you do these push-ups.

Press yourself up and down evenly and slowly while looking straight ahead. This exercise strengthens the chest, shoulder, and arm muscles and is significantly more difficult than standard push-ups because you're increasing the range of motion by dipping lower and pressing up further. You'll probably find this exercise difficult at first, I sure did! But work at it until you can do twenty repetitions. How you arrive at twenty doesn't matter, initially. You may do five sets of four or two sets of ten, just keep at it and make sure your form is as perfect as possible.

The next advanced freehand exercise is the pull-up. This exercise will be familiar to anyone who has served in the military, especially the United States Marine Corps. Pull-ups are similar to chin-ups; however, the hand position is different and the muscles must contract over a longer range of motion, making pull-ups more difficult than chin-ups. Pull-ups also bring additional muscle groups into play, including the upper back and upper chest muscles. Grasp your chinning bar with an overhand grip (palms facing away), hands shoulder width apart. Slowly lower yourself down until your arms and shoulders are fully extended. From the bottom position slowly pull yourself up until your chin clears the bar. Pull-ups strengthen the muscles of the hand, forearm, upper arm, shoulder, and back.

If you're unable to complete one pull-up, follow the same procedure you did with modified chin-ups. Perform partial pull-ups in the upper and lower position and try to control your descent for a count of ten when lowering yourself from the bar. Once you're able to perform one pull-up, work toward completing several in succession. Eventually you'll strive to do fifteen pull-ups, how you arrive at fifteen does not matter. You may do 6, 5, 4 . . . just keep going at it until you get a total of fifteen. Keep your form strict, pull evenly and don't wiggle your body to help get your chin over the bar.

Lower Body Exercises

The advanced leg routine consists of two new exercises: elevated lunges, and platform calf raises. These exercises will develop and strengthen the muscles of the buttocks and the hip, the front and the back of the thigh, and the calf. Strong leg muscles are of particular importance for any fitness-minded person. Strong leg muscles improve locomotion and reduce cardiac strain by aiding the lower body's venous return system. Blood has a tendency to pool in the lower body due to gravity and the weaker muscle system in the walls of veins as compared to arteries. Vigorous contraction of the leg muscles helps push blood back to the heart and reduce the incidence of hypertension and varicose veins. A cardiologist once told me that our legs can be thought of as our second hearts; so building good leg strength should be a high priority.

Elevated lunges are similar to the lunges you did in the intermediate program except that now you'll be stepping up and forward. Stepping up increases the workload placed upon the buttocks and thigh muscles by making the body overcome an inclination. Standing with your feet shoulder width apart, hands on your hips, chin up, back straight, and chest held high, slowly step forward and upward with your left leg onto an eight to ten inch step or block. Step forward as far as possible until your left thigh is almost parallel to the floor. Your right leg should be

held as straight as possible, not bending the knee any more than is necessary. From this position slowly step back to the starting position. Next, slowly step forward with the right leg and perform the same sequence of movement on the right side. Continue alternating back and forth, lunge-up left, lunge-up right - counting each left-right sequence as one repetition until you've completed a total of ten repetitions. Once you're capable of ten repetitions, work towards twenty consecutive lunge-ups.

The advanced calf routine is similar to the intermediate calf routine. Except now you'll be doing elevated calf raises. For this exercise you'll need to construct a simple platform. A platform is superior to a stair step. The platform can be positioned in front of a wall enabling better balance for the advanced calf routine's increased range of motion. Take a twenty inch piece of wooden 2"x4" and cut it into three segments - one ten inch length and two five inch lengths. Drill pilot holes in each end of the ten inch length and attach the five inch lengths with nails in an "I" formation.

Now you've increased the height of your calf raises from the intermediate routine by about four inches. Increasing the calf raises' height will increase the range of motion and the difficulty of the exercise.

Place the calf platform about two feet from a wall. Stand erect with the balls of your feet on the cross board. Keeping your back straight, head up, and legs fully extended, balance yourself by placing your hands against the wall. In that position, shift all your weight to the right leg and place your left foot against the rear of your right heel. Do not let your hips rock backward and forward during this exercise. Slowly raise up on the toes of your right foot as high as possible. Hold this position for a count of five.

This is known as a "pause" and it places additional stress on the calf muscle by sustaining the contraction. Perform as many right-legged calf raises as you can aiming for a total of twenty-five. Change position to the left calf and repeat the same sequence.

Abdominal Exercises

The first advanced level abdominal exercise is called the swimmer's sit-up. This exercise strengthens the three major abdominal areas, the upper and lower abs, and the lateral obliques (side muscles). Lie on your exercise mat in a supine position with your knees bent, feet about

twenty inches apart and flat on the floor. Put your hands on your chest, keeping your elbows wide apart, curl your head and shoulders up off of the mat by contracting your abdominal muscles. At the same time, draw your right knee up toward your chin so that your left elbow and right knee cross. Hold this position for one second and then return to the starting position. However, do not pause; immediately repeat this exercise sequence with your right shoulder and elbow and left knee. Try to keep your feet off of the mat at all times during the exercise. For example, when you draw your right knee up toward your chin keep your left foot about two inches off of the mat. Also, do not allow your upper body to rest flat on the mat. Keep your torso in constant motion, alternating right side, left side, until you've completed fifteen repetitions (a right-left sequence constitutes one repetition). Once you're capable of fifteen consecutive repetitions, work toward twenty-five and then thirty.

The next advanced abdominal exercise is the hanging "L." This exercise strengthens the lower abdominals and aids in decompression of the lumbar vertebrae. Once again we'll be employing the versatile doorway chinning bar. Securely mount your chinning bar in the highest possible position, probably about two inches from the top of the door jamb. Grasp the bar as though you're going to do a pull-up, shoulder width grip, palms facing away. Hang down from the bar so that your arms and torso are completely extended. Keeping your arms and torso as still as possible, raise your legs straight up so that your torso and

your legs are at a right angle to each other. Your knees and feet should be together and fully extended, toes pointed straight ahead. Hold this "L" position without swinging or wiggling for a count of ten. You should strive to hold the "L" for thirty seconds, and then for one entire minute.

If at first you're unable to perform a hanging "L," build up to it by doing partial "L"s. Follow the exact same directions you did for regular "L"s, except this time keep your knees flexed. Flexing your knees shortens the lever system created by your lower body and decreases the

stress on your lower abdominals. Practice partial "L"s until you build sufficient strength to hold a regular hanging "L" for ten seconds.

Cool Down

You should now do the same cool-down and stretching routine you did for the beginning and intermediate level workouts. The "winding down" period is even more critical at this point, since you're now completing more strenuous workouts. Do not skimp or cut corners on either the warm-up and stretching or the cool-down and stretching routines. Sometimes when you've been working out for a while you think you're beyond the basics. This is a mistake; every time I've neglected the proper warm-up or cool-down techniques, I've ended up with a muscle strain. Remember, proper exercise preparation and recovery are just as important as the workout itself.

WORKOUT SUMMARY (Advanced)

ACTIVITY	EXERCISES	*REPETITIONS
<u>Warm Up</u>	(repeat from beginning & intermediate levels)	
** (10 min)		
<u>Strength Training</u>		
** (15 min)	<ul style="list-style-type: none"> - elevated push-ups - pull-ups - elevated lunges - elevated one-legged calf raises - swimmer's sit-ups - hanging "L"s 	<ul style="list-style-type: none"> 20 reps 15 reps 20 reps 25 reps 30 reps 10 secs
<u>Cool Down</u>	(repeat from beginning & intermediate levels)	
** (10 min)		

* these repetitions refer to the optimal number

** limit rest between exercises to $\leq$ 1 min

PHYSICALLY FIT AND BEYOND

In this book I've compiled a series of progressive resistance freehand exercises which I know from my own personal experience, schooling, and research will increase your muscular strength. There are a few key ingredients of physical training which I have intentionally omitted until now. I'm referring to mental attitude, proper diet, and adequate sleep.

Attitude

You must always approach your training with a positive outlook and the firm conviction that you'll succeed. Exercises such as pull-ups and chin-ups, which may initially seem impossible, are possible with consistent work. Don't cave in to resistance, overcome it. Picture yourself pulling your chin up over the bar, steel the image in your mind, and work relentlessly until you get it. The harder you work to attain a goal the more gratifying it will be in terms of self confidence. But, hard work requires motivation and motivation comes from maintaining a positive mental outlook.

Diet

This is not a book on nutrition and I'm not a dietitian. However, I strongly urge anyone who is interested in physical fitness to locate and consult a reputable book, journal, or periodical which outlines proper dietary

habits. Among other things your reference source should contain a caloric guide with parameters specific to your age, gender, body weight, and activity level. Your reference should also indicate what percentage of your daily caloric intake needs to consist of protein, carbohydrate, and fat.

Body Weight

As a footnote to diet I would like to say a few words about body weight. Many people, myself included, compare themselves to others and think, "Oh my gosh Pat and I are the same height, and yet I am twenty pounds heavier. I must be overweight!" This is where the trusty bathroom scale is severely inadequate. A scale simply tells us our weight. A scale tells us nothing about our body composition. Muscles are significantly more dense than fat tissue. Therefore, Pat may be twenty pounds lighter, but still may be fatter. For this reason, I recommend having periodic body composition testing; and, the most accurate measurement is hydrostatic weighing. Many health clubs and universities have hydrostatic weighing devices which are available to the public. An alternative to underwater weighing is skin-fold caliper body fat assessment. This method is slightly less accurate but more readily available.

Sleep

Most adults need between six and eight hours of sleep each night. If you're engaged in a strength training program, then adequate sleep becomes an even greater necessity. Muscle growth takes place during periods of rest; the more disciplined you become with your sleep program the faster you'll progress in your strength training. Sufficient sleep will also lessen your likelihood of muscle strain.

Keep Up The Good Work!

The human body is a fantastic machine with great potential at any age. Put your full concentration and energy into your warm-up, cool-down, stretching, and strength training routines and you'll appreciate the incredible physical control we all have at our disposal.

Above all, it's my intention that this book be enjoyable and rewarding for anyone who reads it. I have devoted most of my life to the pursuit of physical fitness. I know that this focus has given me the drive, discipline, and desire to do my best in other areas of my life. Physical fitness is just the beginning; once our bodies are fit and strong we then have the foundation from which to live up to our other potentials.

APPENDIX B

MANUSCRIPT
EVALUATION FORM
(without graphics)

* Please don't write on the manuscript.

Indicate the extent to which you agree or disagree with each statement by circling the appropriate letter below each statement.

SA--Strongly Agree

A--Agree

U--Uncertain

D--Disagree

SD--Strongly Disagree

N--No Opinion

1. This manuscript was informative.

SA A U D SD N

2. The writing style and format of this manuscript was clear and understandable.

SA A U D SD N

3. This manuscript provided me with novel exercise information.

SA A U D SD N

4. This manuscript contained sufficient "background" information.

SA A U D SD N

5. The introductory section was understandable.

SA A U D SD N

6. This manuscript provided me with good ideas for my own fitness pursuits.

SA A U D SD N

7. The length of this manuscript was appropriate to the material presented.

SA A U D SD N

8. I would recommend this reading material to friends of mine.

SA A U D SD N

9. This manuscript held my interest.

SA A U D SD N

10. Comments:
-
-
-
-
-
-
-

EVALUATOR INFORMATION

Name of Evaluator: _____
(first) (last)

Gender: M F (please circle)

Age: _____

Occupation: _____

Physical Activity Level: (please circle one)

1. Low Level (less than 1 hour of exercise a week)
2. Moderate Level (1 hour of exercise a week)
3. High Level (greater than 1 hour of exercise a week)

APPENDIX C

Pretest Questions

True-False and Multiple Choice Questions Circle the Correct Answer

1. Before beginning any exercise program it's advisable to get: (A) comfortable clothing and shoes, (B) a good night's sleep, (C) a physical exam from your doctor, (D) A and C, (E) all of the above.
2. According to the American College of Sports Medicine's guidelines for physical fitness, a well-rounded conditioning program should include activities that promote: (A) cardiorespiratory fitness, (B) muscle and joint flexibility, (C) muscle strength and endurance enhancement, (D) A and C, (E) all of the above.
3. The most limiting physical decline associated with aging humans in terms of daily activity is: (A) balance and coordination, (B) stamina, (C) muscle strength, (D) B and C, (E) all of the above.
4. Freehand or minimal apparatus calisthenics derive their primary resistance from: (A) barbells, (B) dumbbells, (C) exercise machines, (D) the exerciser's body weight.
5. Pull ups strengthen the muscles of the: (A) upper arm, (B) shoulder, (C) back, (D) all of the above.
6. Regular exercise can benefit older adults mentally by maintaining good brain circulation and reducing stress and depression: T F
7. Bone mineral loss (in older women) may be reversed through weight-bearing physical activity and improved nutrition: T F
8. Strong leg muscles can reduce hypertension and peripheral blood pooling: T F
9. Muscle strength isn't strongly associated with muscle size: T F
10. Body weight is an accurate indication of how "fat" a person is: T F

Post Test Questions

True-False and Multiple Choice Questions Circle the Correct Answer

1. According to the American College of Sports Medicine's guidelines for physical fitness, a well-rounded conditioning program should include activities that promote: (A) cardiorespiratory fitness, (B) muscle and joint flexibility, (C) muscle strength and endurance enhancement, (D) A and C, (E) all of the above.
2. Body weight is an accurate indication of how "fat" a person is: T F
3. Bone mineral loss (in older women) may be reversed through weight-bearing physical activity and improved nutrition: T F
4. Pull ups strengthen the muscles of the: (A) upper arm, (B) shoulder, (C) back, (D) all of the above.
5. Before beginning any exercise program it's advisable to get: (A) comfortable clothing and shoes, (B) a good night's sleep, (C) a physical exam from your doctor, (D) A and C, (E) all of the above.
6. The most limiting physical decline associated with aging humans in terms of daily activity is: (A) balance and coordination, (B) stamina, (C) muscle strength, (D) B and C, (E) all of the above.
7. Muscle strength isn't strongly associated with muscle size: T F
8. Freehand or minimal apparatus calisthenics derive their primary resistance from: (A) barbells, (B) dumbbells, (C) exercise machines, (D) the exerciser's body weight.
9. Strong leg muscles can reduce hypertension and peripheral blood pooling: T F
10. Regular exercise can benefit older adults mentally by maintaining good brain circulation and reducing stress and depression: T F